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GAS ABSTRACTS

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1. GAS INDUSTRY

Canadian Gas

Hume, G. S. THE UTILIZATION OF NATURAL GAS IN CANADA. *Can. Gas J.*, 44, 243-249 (1951) September.

Recent reserves estimates for Canada are 8.17 trillion cubic feet proved, 2.22 trillion cubic feet probable and 2.28 trillion cubic feet possible. With the future needs of the Province in mind, Alberta officials see no possibility of export unless more gas is discovered. Applications for pipelines are reviewed in great detail.

J. D. Parent

Domestic Gas Increase

DOMESTIC GAS USE INCREASES. *Am. Gas Assoc. Monthly*, 33, 13, 14, 40 (1951) September.

The data presented was tabulated from the Census of Housing by the A.G.A. Bureau of Statistics. The general trend is for increased gas use in all domestic applications. Greatest increase in gas uses resulted in the new dwellings that were located within gas company franchise areas. Utilities that distribute natural gas had a greater percentage increase than did manufactured and LP-Gas companies. Increased use of "Bottled" gas was also noted in rural areas.

W. G. Bair

Employee Education

Wilde, H. D. TECHNICAL TRAINING IN INDUSTRY. *Chem. Eng. Progress*, 47, 17, 18 (1951) September.

The author reviews the technical training program offered by his company to its employees. Outstanding workers in a variety of fields of chemistry and engineering present short courses in their fields of specialization. Courses last two to three weeks. Longer courses are offered by staff members. The idea is that education should not stop when one leaves college. New men can advance more rapidly and older men do not become "rusty."

J. D. Parent

Gas Wastage

GAS FLARING HIT. *Oil Gas J.*, 50, 51 (1951) September 27.

Gas waste in Texas rose from 2.3 billion cubic feet in January to 5.5 billion cubic feet in July. This increased waste has been denounced by the State Railroad Commission which feels that waste of gas is as serious as waste of oil.

J. D. Parent

Industry Restrictions

Ralph, H. D. NO BIG GAS LINES SOON. *Oil Gas J.*, 50, 147-149 (1951) October 4.

The opinion has been expressed that there will be no new big transmission lines in the immediate future. This is largely a matter of economic and political obstacles which appear virtually insurmountable. Present lines are expected to expand; however, a list of difficulties is developed.

J. D. Parent

Mexican Gas Export

SINCLAIR-PEMEX DEAL? *Oil Gas J.*, 50, 60, 61 (1951) August 30.

Sinclair is negotiating with Pemex for purchase of excess natural gas produced in northern Mexico for transportation to the U.S.A. Assistance with an exploratory drilling program is also being discussed.

J. D. Parent

Oil and Gas Research

Cattell, R. A., and others. PETROLEUM AND NATURAL GAS RESEARCH PROGRAM BUREAU OF MINES, FISCAL YEAR 1950. U.S. Bureau of Mines Information Circular 7616, (1951) August.

This is a summary of the research work on petroleum and natural gas which was carried out at the Bureau of Mines during 1950. Of special interest to the gas industry are such topics as characteristics of gas-condensate fluids, gas-repressuring, and development of a new point recorder. Short abstracts of accomplishments on each project are given.

J. D. Parent

Solar Energy

Telkes, M. FUTURE USES OF SOLAR ENERGY. *Bull. Atomic Scientists*, 7, 217-219 (1951) August.

Present methods of utilizing solar energy are reviewed with a discussion of their relative efficiencies. This ranges from 50% in a case of solar house heating to 0.1% for photoelectric cells and photosynthesis processes. The limits to the long range availability of "fossil" fuels and atomic energy are cited as justification for the further prosecution of this field of study.

S. Katz

2. APPLIANCES

Burner Safety

Lade, F. L. and Silverton, E. G. SAFETY CONTROL FOR GAS STOVES. U.S. 2,563,944 (1951) August 14.

The principle of thermostatic control of gas burners for safety shut off has been utilized for use on pilot and main burners of stove top burners. Each burner has a thermostat and failure of the flame on the main burner will close a valve in the main gas pipe, causing shut-off of gas to the main burner and pilot burner, thereby eliminating unburned gas, flame ignition source and any possible explosion.

D. L. Nicol

Space Heating

SPACE HEATING IN LARGE BUILDINGS. *Coke and Gas* (British), 13, 319-323 (1951) September.

This article contains a brief discussion of the use of gas for heating large buildings. Nine pictures of various gas-fired boilers include the Cochran boilers, which are said to be 87% efficient.

B. G. Lang

3. COMBUSTION AND INDUSTRIAL FURNACES

Air Pollution

Munger, H. P. AIR POLLUTION AT LOW ALTITUDES: TECHNIQUES FOR STUDY. *Chem. Eng. Progress*, 47, 436-439 (1951) Aug.

Means of sampling air and studying air currents at various altitudes are described. Among the methods of sampling are: continuous sampling of air through a polyethylene tubing which is attached at the ground level to a Thomas Autometer, for SO_2 content; and collecting of aerosol samples through use of a midget impinger (polyethylene tubing extending to the ground furnishes the vacuum) or an electrostatic precipitator. Relative humidity and lapse rate (rate of temperature change with change in altitude) are measured with a wiresonde; wind direction and velocity are determined with a hot-wire anemometer. All of these instruments are raised to the desired altitude by helium-filled Kytoons (kite-balloons). The determination of the concentration of contaminants and of the meteorological elements is important in understanding the dispension potential of the atmosphere.

J. J. Guyer

McCabe, L. C. ATMOSPHERIC POLLUTION. Ind. Eng. Chem., 43, 119A-122A (1951) September.

The author reviews the 2nd annual report of the Allegheny County, Pa., Bureau of Smoke Control. The Bureau reports on an area of 700 sq. miles consuming over 50 million tons of coal annually in 128 municipalities. Domestic heating, railroads and steel industry are involved in air pollution, and active research is under progress in each, especially upon open-hearth, blast-furnace and Bessemer dusts. Of hundreds of coal mine gob-piles in the county, 20 to 25 are burning, and have been under investigation at Mellon Institute and Pennsylvania State College since 1949.

O. P. Brysch

Blast Furnace Gas

NOW BLAST-FURNACE GAS IS BASE-LOAD BOILER FUEL. *Power*, 95, 96-98 (1951) September.

Blast furnace gas is cleaned and used as a base fuel for boilers. New high pressure steam turbines are used to drive alternators to furnish the increased demand for electric power. These high pressure turbines exhaust at 165 psig to furnish the plant with process steam. The blast

furnace gas is cleaned in large spray-towers and also by a mechanical disintegrator. The mechanical disintegrator is an induced-draft fan with a water spray. This produces intimate contact with the gas and water and reduces the dust content of the cleaned gas to less than 0.01 grain per cu.ft. Clean blast furnace gas results in lower maintenance cost for the boiler, and in a lower overall cost for the steam produced.

W. G. Bair

Coal Furnaces

Dalin, D. and Gejrot, C. J. (assigned to Dalin, Sweden) APPARATUS FOR SEQUENTIALLY DEGASSING AND COMBUSTING SOLID FUEL HAVING A LOW SINTERING TEMPERATURE. U.S. 2,567,058 (1951) September 4.

A furnace having an internal cooling arrangement consisting of a series of vertical boiler tubes is suggested for the combustion of solid fuels of low fusion temperature.

C. von Fredersdorff

Miles, J. C. (assigned to Board of Trustees, University of Illinois) COAL COKING AND BURNING MAGAZINE STOVE. U.S. 2,564,713 (1951) August 21.

This magazine stove, developed at the University of Illinois, depends upon the down draft principle to consume smoke and volatiles from a descending coking mass by drawing them across and downward with the primary air first through the lower, actively burning mass of coke. Finally, with adjusted secondary air, the gases pass upward through a refractory combustion chamber to the flue pipe.

O. P. Brysch

Combustion Protective Devices

Steiner, K. and Carter, W. G. ELECTRONIC SAFEGUARDS FOR OIL BURNERS. *Heating, Piping, and Air Conditioning*, 23, 77-85 (1951) September.

Electronic instruments and controls find numerous uses in heating, piping and air conditioning work. This article describes three types of flame safeguard systems together with application and maintenance of such equipment. These three types are: (1) photocell and electronic relay mounted on boiler front; (2) separate housing of relays and photocell or probe rod; (3) the primary program relay, together with a single flame detector, sensitive to infrared, that monitors both the gas pilot flame and the main burner flame.

D. L. Nicol

Combustion Research

Garside, J. E. THE IMPLICATIONS OF COMBUSTION RESEARCH IN GAS UTILIZATION. Gas Research Board, (British), Publ. GRB 57 (1951) August.

A summary of combustion research is made, together with a simple explanation how this fundamental research is contributing to the solution of current problems of gas utilization. To this purpose, the subject of combustion research has been subdivided into six sections entitled Flame Propagation, Flame Stability, Mechanisms of Combustion Reactions, Heat and Energy Release, Heat and Energy Transfer and Ignition of Gas-Air Mixtures.

D. L. Nicol

Lewis, B. and von Elbe, G. COMBUSTION. *Ind. Eng. Chem.*, 43, 1925-1941 (1951) September.

This article presents a review of combustion research in the period from late 1948 to late 1950. It covers such subjects as fundamentals of combustion processes, fundamentals of detonation, jet and rocket propulsion, etc. A bibliography of 824 books and articles is given.

E. F. Searight

Wilson, C. W. and Hawkins, N. J. BLOWOFF OF FLAMES FROM SHORT BURNER PORTS. *Ind. Eng. Chem.*, 43, 2129-2135 (1951) September.

From the concept of a critical boundary velocity gradient, a theoretical expression is developed for estimating the slope of the velocity distribution profile at the port wall for short cylindrical ports. The expression has been tested and proved valid for ethylene-air and propane-air systems using several port sizes. Some divergence of experimental data from expected values was found on very short ports. Possible causes of this divergence are discussed.

E. F. Searight

Explosibility Research

Kennedy, R. E., Spolan, I., and Scott, G. S. EXPLOSIBILITY OF MIXTURES OF PROPANE, AIR, AND CARBON DIOXIDE AND OF PROPANE, AIR AND NITROGEN AT ELEVATED PRESSURES. U.S. Bureau of Mines Report of Investigations 4812 (1951) August.

An investigation was made of the inflammability limits of propane-air mixtures on dilution with carbon dioxide and nitrogen at various pressures. The pressures were atmospheric, 100 psig and 200 psig. It was found that the critical oxygen content required for combustion decreased with increased pressure, and that nitrogen dilution reduces this content more than carbon dioxide dilution.

D. L. Nicol

Zabetakis, M. G., Scott, G. S. and Jones, G. W. LIMITS OF FLAMMABILITY OF PARAFFIN HYDROCARBONS IN AIR. *Ind. Eng. Chem.*, 43, 2120-2124 (1951) September.

An apparatus for determining limits of inflammability at elevated temperatures is described. This apparatus was used by the authors to determine lower limits of inflammability for six paraffin hydrocarbons. A table of lower limits at room temperature of twenty-two paraffin hydrocarbons is given. An average deviation of 8% for 100° C. was found for the lower limits of inflammability of the compounds investigated.

E. F. Searight

Gas Turbine

Imbert, R. J. (assigned to Societe Rateau S. A., and René Anxionnaz France). GAS TURBINE. U.S. 2,565,178 (1951) August 21.

This invention relates to a device for closing the openings between the stationary blades of a gas turbine using a cylinder that slides perpendicularly to the axis of the openings.

E. J. Pyrcioch

Industrial Burner

Nichols, A. R. HOW TO USE THREE FUELS AT ONCE. *Petroleum Processing*, 6, 1005-1007 (1951) September.

The details of a tri-fuel burner are described. Coal, oil and gas can be burned simultaneously in any proportion, provided that the burner is sized for maximum heat release on any single fuel. Coal is fired in a pulverized condition carried in an air stream from a ball mill, oil is fed through a center pipe and gas through a circular ring. Operating details are discussed. The tri-fuel burner has high value for plants contemplating the use of pulverized coal, since immediate substituting of oil or gas may be made during coal shortages.

C. L. Tsaros

Industrial Gas Utilization

Howell, W. F. S. and Seansfield, W. B. THE USE OF GAS IN THE COTTON INDUSTRY. PART III. *Industrial Gas* (British) 14, 356-361 (1951) September.

In addition to uses described earlier in Parts I and II (*Gas Abstracts* 7, 176, Sept.), the applications of gas in operations such as resin impregnating, glazing, coating, and crease-proofing are given. Competition with steam heating is briefly outlined.

O. P. Brysch

Process-Furnace Operation

Buthod, P. PROCESS VARIABLES IN FURNACE OPERATIONS. *Oil Gas J.*, 50, 79-81, 92 (1951) August 30.

Using a formula developed by Wilson, Lobo, and Hottel, the author presents equations and graphs for rapid calculation of the effect of variables controlling the operation of the radiant section of furnaces. The variables studied are excess air, heat liberation, rate of heat absorption, bridge-wall temperature, bridge-wall air, and the convection section.

C. L. Tsaros

FURNACE OPERATION VARIABLES FOR PROCESS PLANT HEATERS. *Petroleum Refiner*, 30, 77-89 (1951) August.

Solutions to a number of problems commonly encountered in the operation of process plant heaters are demonstrated by means of illustrative examples.

H. R. Linden

4. CARBONIZATION AND GASIFICATION

Briquetted Fuels

Vloeberghs, A. (Belgium). AGGLOMERATES OF FUEL AND MANUFACTURE PROCESS. U.S. 2,567,136 (1951) September 4.

The inventor manufactures briquettes from coal dust by cementing with (1) up to 6% waste sulfite liquor, and (2) up to 3% phenol-formaldehyde resin, separately or admixed, claiming for these (1) improved combustion characteristics and (2) greater resistance to water.

O. P. Brysch

BRIQUETTERS VIEW INDUSTRY PROGRESS. *Coal Age*, 56, 134, 182-188 (1951) September.

The second biennial coal-briquetting conference held at Superior, Wisc., Aug. 2-3 is briefly summarized. Domestic and foreign problems and practice were reviewed in 13 papers. Solid fuels, competitive markets, Canadian and foreign practice, machinery, quality control, binders, drying, balling processes and use of Dakota lignite in ore reduction and gasification were the subjects treated.

O. P. Brysch

Carbonization

Myhill, A. R. COAL CHARACTERISTICS IN RELATION TO GAS MAKING. *Gas Times*, 68, 176-8, 181, (1951) August 10; 237, 238, 243, (1951) August 24.

The author gives a brief, balanced review of coal properties and the processes occurring during the carbonization of coal. Part I treats briefly the chemical composition (organic and inorganic), "banded" constituents, cannel coal, and disproportionation of coal constituents during heating. In Part II the influences of the type of retort and of pyrolysis, softening, infusible constituents, and volatile matter upon coke formation and gas release are discussed.

O. P. Brysch

O'Connor, J. A. LIGNITE PROCESS HITS THE MARK. *Chem. Eng.* 58, 107, 219, 222 (1951) September; *Chem. Eng. News* 29, 4089-4090 (1951) October 1; 4270-4274 (1951) October 15.

Large-scale commercial utilization of lignite in aluminum production is scheduled for operation in late 1952, at Waco, Milam County, Texas. The Parry process, developed at the Denver Station of the Bureau of Mines, will be used. This consists of a fluidized drying, low temperature carbonization treatment of local lignite (35% moisture, 7000 Btu) to produce a 45% yield of 10,600 Btu char and 14 gal. tar. The char will be used as fuel for steam generation by the Texas Light and Power Co. for Alcoa's new aluminum reduction plant. Twelve lignite carbonizers of 575 tons/day each, will convert 7000 tons/day of raw lignite to 3200 tons of char and 2300 bbl. tar. Lignite, strip-mined at $1.00 to $1.50/ton and processed, is expected to yield power at 3.5 mills/KWH, or with credit for tar and oil, at 2.5 mills/KWH, which will compete with natural gas at 5 to 8 cents/MCF. The vast Western reserves of sub-bituminous coals are now open to development by the process, yielding first the char for power plant fuel, and second, the tars, which may be burned as crude liquid fuels, or be converted to upgraded motor fuels and tar acids.

O. P. Brysch

Prien, C. H. PYROLYSIS OF COAL AND SHALE. *Ind. Eng. Chem.*, 43, 2006-2015 (1951) September.

In his fourth annual review, the author presents his usual detailed search over the wide spread literature pertaining to coal and shale pyrolysis since June, 1950. With regard to coal, he mentions economics, mechanism, kinetics and thermochemistry. Research on coal properties, blending, plasticity and particular local coals are noted. Effects of various blended materials in production of metallurgical coke are reviewed. Low-temperature carbonization, problems of industrial coke-oven operation, byproduct recovery, improved equipment, coke properties, analysis and testing encompass 20 to 25 references each. Oil shale pyrolysis is reviewed similarly, with about 100 references and 9 illustrations of operations. A total of 277 references is given.

O. P. Brysch

Coal Chemicals Recovery

Pillans, A. PROCESSING CRUDE TAR AND CRUDE BENZOLE. *Gas World* (British) **134**, 151-153 (1951) August 18; *Gas J.* (British) **267**, 396-398 (1951) August 15.

The centralized tar and benzole refinery at St. Anthony, Newcastle-on-Tyne, which processes crudes from adjacent gaworks and coke ovens is described. A blend of 40 horizontal: 20 vertical: 40 coke-oven tar is dehydrated by a "Wikner" Patent (Surface steam-coil) dehydrator to 0.5% moisture, after which it passes to a Wilton continuous tar distilling plant. This consists of pipe-still, distillation column and fractionation column, the latter yielding overhead and sidestream fractions of (1) crude benzole to 160°C. (2) crude naphtha to 200°C. (3) Naphthalene oil to 220°C. (4) Creosote oil to 300°C. and (5) anthracene oil residue. Pitch, road tar phenols and crude benzole products are described.

O. P. Brysch

McNeil, D. THE FUTURE OF COAL TAR. *Gas World* (British) **134**, *Coking Section* 91-96 (1951) September 1.

Possible future improvements in equipment, techniques and output of diversified products are discussed with reference to the currently increasing costs and competition from petroleum products.

O. P. Brysch

Kastens, M. L. and Barraclough, R. CYANIDES FROM THE COKE OVEN. *Ind. Eng. Chem.*, 43, 1882-1892 (1951) September.

A thorough treatment of the recovery of cyanides from coke oven gas by the Koppers "vacuum carbonate" process is given. The rising demand for hydrogen cyanide and its association with H_2S, which is also recovered and burned to form sulfuric acid, make the process attractive to coke oven operators, since these materials are detrimental contaminants in the gas. The Kearny, N. J., plant produces over 4000 lb/day of liquid HCN (98.5%), and about 40 tons H_2SO_4 from H_2S (elemental S is also burned) in the contact-acid plant. Data are given on hazards such as explosions, toxicity and corrosion. Much information is given on plant flow rates, operating techniques, service and utility requirements, special equipment and construction (to avoid polymer explosions) and chemical control. Flow sheets, photographs and bibliography are presented.

O. P. Brysch

Coal Dust Gasification

LATEST IN COAL GASIFICATION. *Chem. Eng.* **58**, 263-267 (1951) September.

A variety of fuels,—heavy refinery residues, peat, lignite, European coals,—have been gasified by the new Panindco (Compagnie Pan-Europeenne d'Installations) process, developed from the work of H. Schmalfeldt and K. Baum on coal dust gasification. The demonstration plant operating since July, 1950, at Grand Quevelly, (Rouen) France, indicates that 4 types of gas may be produced: (1) ammonia synthesis gas; (2) methanol synthesis gas; (3) Fischer-Tropsch synthesis gas; (4) lean gas, the product composition depending upon the direction of flow of the reactants, and whether air or oxygen is used. Air-steam mixture preheated to 1000°-1500° C. acts as the primary reactant and carrier gas in the process.

O. P. Brysch

Coal Expansion

Brysch, O. P. and Ball, W. E. EXPANSION BEHAVIOR OF COAL DURING CARBONIZATION. Institute of Gas Technology, Chicago, *Research Bulletin* **11**, (1951) October.

Of the voluminous literature on coal carbonization and coal properties, in excess of seven hundred references have been scanned, and some two hundred references, of special significance to the factors involved in the expansion behavior of coal during carbonization and the origin, magnitude and measurement of the expansion pressures developed by coals and coal blends, have been critically reviewed. A summary of the more significant findings and opinions appears in the body of this report. This literature survey has been supplemented by first-hand inspection of current coke oven practice in modern plants.

A special study and analysis has been made of possible correlations between expansion pressures developed during carbonization and the

properties of coal which were measured in the laboratory. From such correlations it was hoped that a definite and scientific prediction could be made of the anticipated expansion behavior during carbonization, to assist the operator in the selection and blending of coals for his oven charges, rather than the current more costly and time-consuming pilot-oven tests. The conclusion was reached that while none of the correlations hitherto attempted permit coke oven behavior to be predicted from laboratory determinations of coal properties, nevertheless, attainment of this goal is within the possibilities of further intensive research.

To this end a concrete research proposal is outlined, the essential feature of which is the procurement of an adequate series of representative coals of known expansion behavior and coking properties, especially those coals of similar chemical composition but of different known expansion behavior, as predetermined in Russell oven tests and plant use by cooperating coke producing companies. The physical properties of this series of coals will be exhaustively studied by existing laboratory techniques, and the internal structure will be studied by newly developed procedures using the latest in laboratory equipment. If no successful correlations can be found, further research is proposed to develop new methods for the direct measurement of the rates of gas evolution and the resistances to gas escape believed to be the primary causes of coal expansion pressures.

Authors' Abstract

Coal Structure Research

Gillett, A. THE SOLUBILITY-CONFERRING OXIDATION OF COAL. *Fuel* (British) **30**, 181-187 (1951) August.

The author reports further on his theory of the existence of a dominating fundamental material, probably of macromolecular colloid type, and of C_{29} composition in all coals, as based upon reactions with oleic acid. Experimental results on bituminous coals which have been highly oxidized (rendered totally soluble in caustic alkali solution) are compared with those of other workers, and the soluble product, reflocculated by acid, has been shown to approximate C_{20} in composition. This material, named "anthaxylic acids" by G., when oxidized further, rapidly decomposes to CO_2, CO, benzenepolycarboxylic acids, and simpler carboxylic acids. Structural formulae are presented to trace the possible course of such oxidation.

O. P. Brysch

Oele, A. P., Waterman, H. I., Goedkoop, M. L. and Van Krevelen, D. W. EXTRACTIVE DISINTEGRATION OF BITUMINOUS COALS. *Fuel* (British) **30**, 169-177 (1951) August.

The extraction of Dutch bituminous coals at temperatures ranging from 200° C. up to 400° C. is described. The role of the solvent structure is discussed and the conditions allowing for almost complete disintegration (dissolution) of the organic coal matter are reported. The kinetics of the extractive disintegration below 350° C. are interpreted in the form of an extraction velocity equation, which fits the results fairly well. It is shown that the extractive disintegration of Dutch coking coals can be compared with a thermal decomposition, requiring activation energies of 20 to 40 kcal. Special attention has been paid to destructive extraction with partially hydroaromatic solvents at temperatures above 300° C. The importance of the transfer of hydrogen during this kind of extraction is stressed; the application of diphenylamine as a hydrogen-transferring catalyst is reported. With 9, 10-dihydroanthracene as a source of reactive hydrogen, the coal undergoes reduction even below 350° C.

Authors' Abstract

Ruof, C. H., Savich, T. R. and Howard, H. C. NUCLEAR STRUCTURE OF THE WATER-SOLUBLE POLYCARBOXYLIC ACIDS FROM OXIDATION OF BITUMINOUS COAL. *J. Am. Chem. Soc.*, **73**, 3873-3879 (1951) August.

The structures of the polycarboxylic acids prepared by the oxidation of bituminous coal have been studied. Significant amounts of compounds with nuclear structures more complex than the benzene ring are present. The method of degradation used—oxidation, followed by esterification, hydrogenolysis and fractionation—appears applicable to investigations of coal structure.

C. H. Riesz

Cooling and Washing

McKean, J. B. GAS COOLING AND WASHING PLANT. *Gas J.* (British) **267**, 347-354 (1951) August 8; 402, 407-9, 417 (1951) August 15; *Gas World* (British) **134**, 162-168 (1951) August 25; 188-192 (1951) September 1.

This is a thorough discussion of the selection and design of the equipment used for the wet purification of coal gas. The effects on operating conditions of heat and water vapor content of the gases themselves, ratios of condensates, ammonia, and fog due to tar are described. Cost comparisons of cooling water and cooling surface are made. The problems of naphthalene and tar removal and ammonia washing are treated in detail. A brief description of a new unit-purification plant concludes the article. The discussion following the paper made particular reference to temperature difference in primary and secondary coolers, effect of CO_2 on efficiency of ammonia scrubbing, heat load, water requirements and temperatures, heat transfer, naphthalene deposition, and electrostatic detarring.

C. L. Tsaros

Electrode Carbons

Zert, K., (assigned to United Chemical and Metallurgical Works, Czechoslovakia) METHOD OF MANUFACTURING CARBON DEPOLARIZATION BODIES FOR ATMOSPHERIC OXYGEN ELEMENTS. U.S. 2,566,-105 (1951) August 28.

Carbon depolarizing electrodes are produced by molding carbonaceous materials, such as sawdust, peat, charcoal, wet and made plastic with activating solutions such as $ZnCl_2$ or phosphoric acid. The shaped bodies are dried, annealed at 800-1000° C and washed; a second annealing improves the consolidation of the substance.

O. P. Brysch

Gasification in Germany

GASIFICATION OF WASHERY REJECTS AND PULVERISED FUEL. *Gas World* (British) **134**, 142-145 (1951) August 18.

Because of the increasing demand for gas, Germany has attempted to increase the utilization of low grade fuels. For example gas for oven underfiring was manufactured in limited quantity from high inert material using intermittent generations such as the Rombach and Schweitzer producers. A Lurgi pressure gas producer is operating on Ruhr bituminous coal and a cyclone gasifier is under development for handling coal-fines in suspension. Low temperature carbonization of washery rejects, shale, and briquetted fines was carried out in an Otto retort pilot plant. Using washery rejects of $\frac{3}{8}$ to $2\frac{3}{8}$ in. size containing 14.5% carbon and 77.3% ash, this pilot retort produced a gas of 100 Btu heating value when operating with preheated air and steam. Experiments with the Ruhrgas cyclone indicated that gases varying from 70 to 105 Btu could be produced using both soft and hard coals in suspension with preheated air.

C. von Fredersdorff

Gas Reforming

Anuskiewicz, M., Jr. HOW NATURAL GAS IS USED AT GREENPOINT WORKS. *Gas* **27**, 33-7 (1951) September.

The use of natural gas at the Greenpoint Works of the Brooklyn Union Gas Co. is described. Gas arrives through a 16-inch line at up to 350 psig pressure. Operations covered include dust removal, metering, mixing, reforming in water-gas sets, coke oven underfiring, boiler underfiring, conditioning (fogging, humidifying, odorizing) and instrumentation.

C. H. Riesz

Horsfield, S. W. CONTINUOUS CATALYTIC CRACKING PROCESS USED TO REFORM NATURAL GAS. *Am. Gas J.*, **175**, 17-20 (1951) September.

This paper, describing the catalytic cracking plant at Glenwood Landing, Long Island, was presented at the AGA Production and Chemical Conference in May, 1951. (see *Gas Abstracts*, 6, 126 (1950) July). However, operating results of the first seven months are now presented. These show that mixing of modifying air with a carrier gas containing a high percentage of steam, gas and natural gas has increased the hydrogen-to-inerts ratio of the finished gas.

C. H. Riesz

Slater, R. L. RECENT DEVELOPMENTS IN CATALYTIC GAS REFORMING. *Gas Times*

(British), 68, 319-320 (1951) September.

Gas Machinery Company (Cleveland, Ohio) has perfected production of 28-foot lengths of jointed silicon carbide tubes for use in catalytic gas reforming. Whereas commercial alloy tubes are limited to a maximum of 1900° F., the silicon carbide tubes containing nickel oxide catalyst can be heated safely to 2700° F. Following successful pilot tests, an installation capable of producing 12,000 CFH of reformed gas has recently been put on stream at Three Rivers, Quebec. Another unit employing the same principle is now being erected in Belgium, rated capacity 140,000 CFH of carrier gas.

C. H. Riesz

Weber, G. NEW REFORMING CATALYST. *Oil Gas J.*, 50, 167, 168 (1951) September 20. [Based on a paper presented before the Fuel, Gas and Chemistry Section, XII International Congress of Pure and Applied Chemistry, by E. C. Hughes, H. M. Stine, H. A. Strecker, S. C. Eastwood, C. L. Gutzeit, W. A. Stover and S. J. Wantuck]

On the recently announced T.C.R. (Thermofor Catalytic Cracking) process, a coprecipitated bead catalyst, 20 mol-% chromia and 80 mol-% alumina, will be used. The T.C.R. process resembles the T.C.C. process in the use of a moving catalyst bed reactor with regeneration in a separate kiln. Hydrogen is re-cycled to aid in suppressing coke deposition, which is not allowed to build up to more than 3% by weight of the catalyst. High yields of aromatics are obtained at 100 psig reactor pressure. At 100-175 psig, sulfur reduction ranges from 86-97%. The first commercial installation will be a 3000 bbl./day unit at Augusta, Kansas.

C. H. Riesz

NEW PROCESS PLANT PLACED IN OPERATION. *Am. Gas J.*, 175, 31-46 (1951) September; *Chem. Eng.* 58, 236 (1951) October; *Gas Age* 108, 29, 30, 72, (1951) September 27.

A Koppers-Hasche demonstration plant has recently been placed in operation at the East Plant of the Rochester Gas and Electric Co. The maximum input of 300,000 CFH of natural gas produces slightly over 1,000,000 CFH of 300 Btu. gas. This gas cold enriched with natural gas gives 1.4 million CF of 537 Btu. city gas. Air and natural gas in 1-to-1 proportions is fed at alternate ends of the 20-foot furnace at one minute intervals. The periodic reversals maintain the hottest zone in the center at 1500-1600° F. The furnace is checkered with a core of tile, 9 inches by 20 inches high, divided in the center by a reaction chamber, where catalyst can be placed if desired. The unit occupies a space 42 by 21 feet, and, except for the cooling tower, is less than 10 feet high. A Hasche furnace is already in operation at Johnson City, Tenn., supplying the entire gas needs of that city.

C. H. Riesz

PEAK LOAD GAS BY CATALYTIC REFORMING AND METHANATION FROM COMMERCIAL SULPHUR-BEARING NAPHTHA. *Am. Gas Assoc.*, Gas Production Research Comm., Research Bull. No. 3, Project PE-5.

The Gas Production Research Committee sponsored a 30-day test of a gas production process developed by Surface Combustion Corporation. The trial run was successfully completed with no major difficulties. Naphtha was distilled and 90% of the overhead was vaporized and mixed with steam as the feed to the reforming tube (26 feet long, 8 inches in diameter, contained 5.78 cubic feet of nickel catalyst). The cracked gas after passage through an iron oxide box had an organic sulfur content of 0.06 grains/C.C.F. This gas was passed to the methanator which contained a 2-inch layer of nickel-magnesia catalyst on a tray 4 feet in diameter. The heat of methanation was removed by recirculating at rates varying between 7-to-1 and 2-to-1, near the end of the test. The heating value of the product gases approximated 520 Btu/C.F., although some high values were obtained in several periods. The sulfur distribution was determined throughout the test and showed that 98.5% was removed in the reforming and purifying steps. The product had a total sulfur content averaging 0.013 grains/C.C.F. Estimates for a 5000 MCF per day plant indicate a total cost of $180 per MCF of daily capacity of which $150 is for the cracking plant and $30 for the methanator. The finished gas would have a heating value of 520 Btu/C.F.

C. H. Riesz

Hydrogen from Hydrocarbons

Scharman, W. G. (assigned to Standard Oil Development Co.) PRODUCTION OF HYDROGEN FROM HYDROCARBON GASES. U.S. 2,565,395 (1951) August 21.

A process for producing a gas rich in hydrogen from gaseous hydrocarbon mixtures containing olefins. The inventor claims that by pretreating such gases with steam at 900 to 1600° F. over a nickel catalyst the olefins are converted into carbon oxides, thereby preventing carbon formation in the paraffin conversion step. Special procedures for obtaining optimum catalyst activity and multistage catalysts are described.
H. R. Linden

Lurgi Gasification

AUSTRALIAN NEWSLETTER. *Chem. Ind.* (British), 758, 759 (1951) September 8.

A contract for the installation at Morwell of a Lurgi pressure (400 psig) gasification unit has been made. About 450 tons/day of brown coal briquettes will be gasified with 100 tons/day of oxygen. Six units, each of which generates 3 million cu.ft./day of gas, are scheduled to be completed by 1956. Experimental carbonizing of Victorian brown coal in a fluidized bed pilot plant has been carried out for some time. A larger pilot plant is contemplated.
C. H. Riesz

New British Ovens

Gross, J. COKE-OVEN EXTENSIONS AT BECKTON. *Coke and Gas* (British), 265-270 (1951) August.

Two new batteries, each of 30 W.D.-Koppers hairpin-flue type ovens, completed during the post war period, are described. Nominal throughput per battery is 600 tons of coal, yielding 7.5 MMCF of 560 Btu gas per day. Complete condensing, byproduct recovery and oxide purifier systems are provided for each new battery, and 9 new mechanized gas producers provide battery fuelgas. These additions have doubled the size of the coke plant.
O. P. Brysch

MORE GAS FOR SOUTH WALES.—INAUGURATION OF THE NANTGARW COKE OVEN AND BY-PRODUCT PLANT. *Gas World* (British) 134, 255-259 (1951) September 22; 282, 283, September 29; *Gas Times* (British) 68, 408, 410, (1951) September 21; *Coke and Gas*, (British) 13, 303-315 (1951) September.

Britain's first new coke plant completed by the Natural Coal Board on an entirely new site is described. The plant is supplied by a newly developed mine at Nantgarw near Cardiff, Wales. The plant comprises 48 Simon-Carves twin-flue underjet ovens (24 to be added later), each of 17 tons capacity, carbonizing eventually 1500 tons washed coal/day at 18 hours coking time, and producing 1100 tons coke, 18 MMCF gas, 11 tons conc. ammonia, 2,700 gal. motor benzole and 45 tons tar. Some details of the handling, byproduct, producer gas and power plant are also given.
O. P. Brysch

UNIQUE SOLID FUEL PLANT. *Gas World* (British) 134, 228-231 (1951) September 15; *Gas Times* (British) 68, 396, 399, 400, (1951) September 15; *Gas J.* (British) 267, 626-627 (1951) September 12.

A brief description, with illustrations, is given of the National Coal Board's plant at Aberaman, Aberdore, (Wales), which produces "Phurnacite", a carbonized, pitch-bound briquetted fuel from washed low-volatile fines. The capacity has been doubled by the recent start-up of 40 new coke-ovens and ancillary equipment. The output of 300,000 tons/year will help fill the unsatisfied demand for this high-grade domestic fuel.
O. P. Brysch

Oil Gas Production

Faber, W. F. (assigned to David L. Sherman, Flushing, N.Y.) APPARATUS FOR CONTINUOUSLY PRODUCING COMBUSTIBLE GAS. U.S. 2,563,460 (1951) August 7.

The invention relates to the manufacture of a 540-Btu gas by partial combustion of liquid and gaseous hydrocarbons with oxygen-enriched air at reactor temperatures from 1300 to 1800° F.
H. R. Linden

Schutte, A. H. (assigned to The Lummus Co.) PROCESS FOR PRODUCING GAS FROM OIL. U.S. 2,561,419 (1951) July 24.

This invention relates to the continuous production of fuel gases of controlled heating value

by cracking heavy oils on a moving bed of hot coke, ⅛ to one inch in size, to a high heating-value oil gas and then blending this gas with a low heating-value producer gas generated from the coke particles with air and steam in a separate generator. The apparatus makes provisions for oil preheating, an elevator for transporting the coke particles from the oil gas generator to the producer gas generator, and fractionation of liquid products with recycling of the residuum to the oil gas generator.

H. R. Linden

Sulfocarbon Uses

de Simo, M. (assigned to Great Lakes Carbon Corp.) EXPLOSIVE COMPOSITION. U.S. 2,566,602 (1951) September 4.

The sulfo hydrocarbons and sulfocarbons, produced by mixing and heating sulfur with pitch or asphalt to 625° F. and then calcining at 1300° F., are proposed as raw materials for the manufacture of blasting powders.

O. P. Brysch

Sulfur Recovery

SULPHUR RECOVERY AND THE BELGIAN CARBONISATION INDUSTRY. *Coke and Gas* (British) **13**, 326 (1951) September.

The distribution of sulfur in the products of coal carbonization is given. Reference is made to the "Hydrosulph" process (which is in use on a pilot scale) for sulfur recovery from gases. Hydrogen sulfide is absorbed in caustic soda solution producing sodium sulfide which is said to be more valuable than elemental sulfur. This product of 96 per cent purity is recovered, permitting a profit to be made on the process. Relative cost data for other purification processes are given.

C. E. Hummel

Sulfur Removal

THE CATALYTIC REMOVAL OF SULPHUR FROM TOWN GAS. *Gas Times* (British), **68**, 174 (1951) August 10.

This catalytic process is effective for reduction of the sulfur content of a gas from 20-25 grains to 3-4 grains sulfur per 100 cu. ft. Nickel subsulfide, on porous, fired china clay, is used at 280° - 320° C. to convert carbon disulfide and carbon oxysulfide to sulfur dioxide and hydrogen sulfide. Subsequent treatment of the gas in a countercurrent wash of soda-ash solution removes sulfur dioxide. Hydrogen sulfide is removed in a tower charged with a special iron oxide packing. Units of 1000 and 2000 cu.ft. per hour capacity have been developed. References are made to British Patents covering the catalytic process and the oxide purification.

C. E. Hummel

Synthesis Gas Production

Mayland, B. J. and Clark, A. (assigned to Phillips Petroleum Co.) MANUFACTURE OF SYNTHESIS GAS. U.S. 2,566,620 (1951) September 4.

The patent relates to the manufacture of synthesis gas mixtures of CO and H_2 from methane using a two-stage fluidized generator containing iron oxide as an oxygen carrier. The product gas is produced by oxidation of the methane in a reactor operating at approximately 1600° F. and the spent oxide heat-transfer material is re-oxidized in a regenerator operating with 2500° F. combustion products, with continuous circulation of solids maintained between the two vessels.

C. von Fredersdorff

Underground Gasification

Dunningham, A. C. THE UNDERGROUND GASIFICATION OF COAL. *Coke and Gas* (British), **13**, 277-280 (1951) August.

Experimental underground gasification of coal in Britain and the United States is discussed. It is pointed out that this process is at present economically sound primarily in the utilization of coal from seams not suitable for conventional mining. Gas of a maximum thermal value of about 100 Btu. may be expected, and production at the rate of 120 therms per ton of coal is an average yield figure. The gas appears suitable principally for use in a gas turbine. Engineering methods employed in the process are compared and evaluated. Of special concern is the progressive deterioration of the quality of the make-gas as the operation proceeds.

S. Katz

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Carbon Black

Krejci, J. C. (assigned to Phillips Petroleum Co.) PRODUCTION OF CARBON BLACK. U.S. 2,564,700 (1951) August 21.

This patent is concerned with a process apparatus for producing carbon black from hydrocarbons. Hot gas from a combustion chamber and reactant hydrocarbon gas are fed separately and tangentially into a cylindrical chamber in such a way that they flow spirally, the combustion gas flowing primarily along the wall, heating it and keeping the carbon black from it. Heat is supplied to the hydrocarbon gas along the surface of mixing of the two gas steams and by radiation from the walls. The hot gases issuing from the reaction chamber are quenched and the product separated by any of the usual means.

J. D. Parent

Stokes, C. A. (assigned to Godfrey L. Cabot, Inc.) PROCESS OF PRODUCING CARBON BLACK. U.S. 2,564,736 (1951) August 21.

This invention relates to a process for making both carbon black and synthesis gas. Natural gas and oxygen are the raw materials. Recycling part of the off-gas from the carbon black separator to the furnace is said to aid in the control of the process.

J. D. Parent

Dust Removal

Brown, C. A. NATURAL GAS CAN BE CLEANED OF DUST AT REGULATING STATIONS. *Am. Gas J.*, **175** 34-36, 44, 45 (1951) July.

The difficulties encountered at Rochester Gas and Electric Corp. arising from the conversion from manufactured to natural gas are described. These were thought to have their origin in dry iron oxide dust brought in with the gas. Three general types of dust filters are thoroughly described and their advantages listed. There are the Dollinger Sta-New Filter, The Aerotec filter and the Blaw-Knox Gas Cleaner. Installation of the new filters has successfully removed the dust.

C. L. Tsaros

Gas Conditioning

Utermoehle, C. E. CHANGEOVER GAS CONDITIONING. *Am. Gas Assoc. Monthly*, **33**, 7, 26, (1951) September.

With the conversion of the Consolidated Gas Electric Light and Power Co., Baltimore, to a natural gas send out, the advantages of gas conditioning were considered. The program setup included both humidification and oil fogging. The advantages for this company were: 1) water is effective in swelling jute, thereby minimizing joint leaks; 2) water is a desirable adjunct to oil-fog for dust control since the oil-fog may not coat all pipelines effectively for a considerable period and water may provide the only dust control during this interim period; 3) oil fog will give more assured and lasting control of dust than can be effected by moisture alone; 4) the coating of oil-fog on the rust in the mains minimizes the removal of odorant from the gas by sorption or catalytic conversion to less odorous compounds.

D. L. Nicol

Gas Holders

Knight, G. F. DESIGN AND CONSTRUCTION DETAILS OF TORONTO'S NEW HOLDER. *Gas Age* **108**, 38-40, 72-76 (1951) September 27.

Some of the design and construction details of a 10,000,000 cu.ft. panel-type gas holder are discussed. The standard water tank multiple-lift holder was built with an internal oil storage capacity of 5,000,000 U.S. gal.

B. E. Hunt

THE WIGGINS GASHOLDER. *Gas J.* (British) **267**, 570-572 (1951) September 5.

The Wiggins dry seal gas holder is described. The holder utilizes neoprene-impregnated asbestos-fabric curtains to maintain a gas tight seal between the polygonal bell and the shell wall of the holder. Sketches showing the operating principle of the holder are included.

W. G. Bair

LP-Gas Handling

Norway, H. L. (assigned to The Bastian-Blessing Co.) GAS DISPENSING DEVICE. U.S. 2,564,226 (1951) August 14.

This invention relates to an improved method and apparatus for handling liquefied petroleum gas where the storage tank is buried below the frost line of the ground to absorb heat from the earth. The apparatus incorporates filling, gaging, venting and regulating devices. Means are provided for introducing compressed air (20 - 25 psi) into the tank by the service man. This air pressure is sufficient to force the liquid along the service line to a point where heat is available even after the sensible heat in the tank is insufficient to vaporize the liquid. Air applied at 10% outage is sufficient when outage is 80%.

O. T. Bloomer

Turnan, J. L. HOW TO UNLOAD AND STORE LP-GAS WITH THE MAXIMUM SAFETY. *Gas Age*, **108**, 40-43, 79-84 (1951) August 16.

The article describes the operations involved in unloading tank car shipments of LP-Gas. Diagrams and description of tank car construction are easily understood. Safety features are emphasized. A step by step breakdown of the unloading operation is given.

W. G. Bair

LP-Gas Vaporization

Fleming, J. C. LIQUEFIED GAS DISPENSING SYSTEM. U.S. 2,564,526 (1951) August 14.

This invention relates to a system for vaporizing liquefied petroleum gases. A thermosyphonic circulating system is employed for utilizing the liquid in the tank to aid in the vaporization of the withdrawn gas. This is accomplished by an upright heat exchanger on top of the tank.

O. T. Bloomer

Garretson, O. L. (assigned to Phillips Petroleum Co.) LIQUEFIED GAS EVAPORATOR. U.S. 2,561,506 (1951) July 24.

This invention relates to an evaporator for vaporizing liquefied petroleum gases. Special mechanical construction is provided for keeping heavy ends from being evaporated and to minimize the superheating of the vapors when only small quantities of material are being evaporated.

O. T. Bloomer

New Pipe Lines

Pierce, J. C. 5700 MILES OF CONTROLLED ENERGY. *Compressed Air*, **56**, 228-234, (1951) September.

This is the story, in non-technical language, of the El Paso Natural Gas Company's pipeline system.

J. D. Parent

Resen, F. L. TEXAS EASTERN PROJECT. *Oil Gas J.*, **50**, 58 (1951) September 27.

Work is progressing on Texas Eastern's expansion of pipe line facilities and underground storage. When completed the system will have more than 4,000 miles of pipeline with sales of 1.2 billion cubic feet per day.

J. D. Parent

GAS LINE OPENED. *Oil Gas J.*, **50**, 155, (1951) October 4.

Gas has begun flowing through the new Trunkline Gas Co. a month ahead of schedule. Completion of this line, with its 250 MMCF per day delivery, increases Panhandle Eastern's capacity to 850 MMCF.

J. D. Parent

NATURAL GAS LINE REACHES NEW ENGLAND. *Construction*, **33**, 82-87 (1951) September.

Construction of Northeastern Gas Transmission Co.'s three spreads of 24 in. line in Massachusetts is described. These spreads are connected to Tennessee Gas Transmission Co.'s line from south of Albany, and will later join near Springfield a second line from Transcontinental Gas Pipe Line Corp. through western Connecticut. A considerable portion of the article is devoted to a description of the X-ray examination of the welds.

J. J. Guyer

Odorization

Turk, A. and Bownes, K. INADEQUATE STIMULATION OF OLFACTION. *Science*,

114, 234-236, (1951) August 31.

Studies of odorization require a test space with a zero level of odor as a control room, or for comparison of concentrations. Experimental data upon odor removal with activated carbon and silica gel filters is discussed. The first yields an inert aerosol, in amounts less than 9 millionths of 1%, which gives rise to a "yeast-like" stimulus. Some theories of odor are discussed.

O. P. Brysch

White, C. E. NEW INSTRUMENT DESIGNED TO DISCLOSE ODOR CONCENTRATION LEVELS IN GAS. *Am. Gas J.*, **175**, 8-11 (1951) August.

The odorimeter described requires only a single stream of gas (whose odor is to be measured) for operation. Odorant is completely removed from a known proportion of the gas, which is then mixed with the odorized fraction to supply a sample for odor-intensity determination. Weber's Law is discussed and illustrated with test results obtained with the odorimeter. An absolute scale of odor intensity, based on the logarithm of the reciprocal of the threshold, is suggested.

C. E. Hummel

Production

NEW SHOT METHOD. *Oil Gas J.*, **50**, 83, 84 (1951) October 11.

New York State Natural Gas Corp. is now using a shaped charge for vertical penetration of cap rock rather than to drill through and risk having the tools thrown out of the hole with its attendant hazards, including the possibility of causing fire by sparks.

J. D. Parent

MOUNTING COSTS EYED: DRILLING-PRICE SURVEY. *Oil Gas J.*, **50**, 180-187 (1951) September 20.

A series of articles reporting a detailed survey of drilling costs is presented. There is a great demand for rigs, but the profit to the contractor is very low due to increased costs.

J. D. Parent

Reserves

Davis, R. E. A METHOD OF ESTIMATING GAS RESERVES. *Oil Gas J.*, **50**, 99, 103 (1951) September 27.

This article presents a very brief review of the methods of estimating gas reserves, balanced by a survey of the gas producing areas of the U.S. and their proven reserves.

O. T. Bloomer

Stripping Control

Ribble, J. M. (assigned to Phillips Petroleum Co.) METHOD FOR MAINTAINING HEATING VALUE OF A FUEL GAS. U.S. 2,564,791 (1951) August 21.

In the operation of a natural gas stripping plant it is desirable to maintain a uniform heating value of the product gas. The recording calorimeter has been adapted to control the reboil heat to the absorption oil to control the fraction of gaseous hydrocarbons absorbed and the heating value of the product-gas stream.

D. L. Nicol

Transmission Controls

Alter, A. C. HOW SOUTHERN CALIFORNIA EMPLOYS TELEMETERING AND REMOTE CONTROL. *Gas Age*, **108**, 42-45 (1951) September 13.

Various telemetering installations are described and illustrated.

B. E. Hunt

Masheter, W. L. PRESSURES TELEMETERED ON BIGGEST INCH DESPITE LACK OF COMMERCIAL POWER AT TRANSMITTERS. *Gas*, **27**, 87, 88, 90 (1951) September.

The big problem was obtaining a constant-speed motor of low torque to drive the cam-shaft for the telemeter transmitter. A satisfactory D.C. motor is manufactured by the Hayden Company. Power supply for this motor is obtained from standard 6-volt auto batteries. Line for transmitting the impulses from the telemetering stations was leased from a telephone company.

W. G. Bair

Underground Storage

Bradley, R. C. HOW UNDERGROUND STORAGE PREVENTED GAS SHORTAGE. *LP-Gas* **11**, 46, 47, 95-97 (1951) September.

The Texas Natural Gasoline Corporation has made use of underground storage in a cavern

leached out of a salt bed. Of about two million gallons of propane stored last summer, 96% was recovered. Specifications were met by the withdrawn propane except for a trace of moisture which was extracted by loading-rack dehydrators. Additional storage capacity of equal amount is now available.

J. D. Parent

HUGE UNDERGROUND STORAGE POOLS WILL HELP SUPPLY EASTERN MARKETS. *Gas Age*, **108**, 23-24 (1951) August 30.

New York State Natural Gas Corp. is developing two large gas storage pools in Pennsylvania, one in cooperation with Texas Eastern Transmission Corp. The pool near Jeannette, Pa. will cost $40,000,000 to develop and will have an ultimate capacity of 100 billion cu.ft. The second pool, which is in Indiana County, Pa., will cost $9,000,000 and have an ultimate capacity of 13 billion cubic feet.

O. T. Bloomer

MISSISSIPPI RIVER FUEL'S NEW GAS-STORAGE PROJECT O.K.'D. *Oil Gas J.*, **50**, 101 (1951) August 30.

Mississippi River Fuel Corp. has received permission to construct and operate underground storage facilities in Waterloo oil field, Monroe County, Illinois. Capacity is estimated at 13 billion cubic feet of which 1⅓ billion cubic feet will be cushion gas. Deliverability is expected to be 50 million cubic feet per day through 25 wells.

J. D. Parent

UNDERGROUND STORAGE FOR MISSISSIPPI RIVER FUEL. *Petroleum Engr.*, **23D**, 58 (1951) September.

The FPC has authorized Mississippi River Fuel Corp. to construct and operate underground storage facilities near St. Louis. Detailed capacity and deliverability figures are given.

J. D. Parent

Well Corrosion

Schock, D. A. and Sudbury, J. D. PREDICTION OF CORROSION IN OIL AND GAS WELLS. *Petroleum Engr.*, **23B**, 86-96 (1951) Reference Annual.

A more comparable result has been obtained when corrosivity in oil and gas wells has been correlated to acidity rather than to galvanic action. Various methods of attack such as measurement of pH, amount of CO_2 or fatty acid present, iron lost in solution, and coupon insertion methods have been tried. All indications for the mechanisms of corrosion seem to point to the combined effect of dissolved CO_2 and lower fatty acids in the water phase. These methods are still in developmental stage, for similar results in another well are not necessarily the end products of similar mechanisms.

S. Mori

Sims, C. I. EXTERNAL CORROSION OF GAS AND OIL WELL CASINGS. *World Oil*, **133**, 262-265 (1951) September.

The magnitude of currents flowing into wells from non-insulated gathering lines is discussed. The survey technique employed is described.

B. E. Hunt

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Aromatics Production

Hepp, H. J. (assigned to Phillips Petroleum Co.) AROMATIC RECOVERY PROCESS. U.S. 2,566,613 (1951) September 4.

The inventor proposes a silica-gel adsorption system for separating aromatic and paraffinic hydrocarbons, in which butane under pressure is used to flush the paraffins from the surfaces and pores of the saturated vessel, after which butane at 500° F. is used to desorb the aromatics. Interconnection of fractionator and the 3 adsorbers permits heat exchange and cyclic operation.

O. P. Brysch

Olsen, J. L. (assigned to Sun Oil Co.) CONTINUOUS ADSORPTION PROCESS. U.S. 2,564,717 (1951) August 21.

A continuous adsorption process is disclosed which utilizes a moving bed of adsorbent, such as silica gel or activated carbon. Separation of a charge comprised of aromatic and saturated

hydrocarbons into an aromatic product and a saturated non-aromatic product is accomplished. C. H. Riesz

Shell Development Co. SHELL BENZENE RECOVERY PROCESS. *Petroleum Refiner*, 30, 233-234 (1951) September.

The Shell process uses extractive distillation, with solvents such as phenol, cresylic acids or sulfolanes, to separate benzene from non-aromatics. The steps in the process are: (1) prefractionation (with two 65-tray columns); (2) extractive distillation (one 65-tray column); (3) solvent stripping (one 30-tray column). The benzene product may then be acid washed. Shell Oil's Wilmington refinery has been producing benzene from reformed petroleum by this process since early 1950. A flow sheet is given. O. P. Brysch

Stone & Webster Eng. Co. MODIFIED EDELEANU PROCESS FOR RECOVERY OF AROMATICS. *Petroleum Refiner*, 30, 237-238 (1951) September.

The well-known Edeleanu process, as modified by Stone & Webster, utilizes liquid SO_2 to extract aromatics from paraffin and naphthene distillates. By operating at —60°F., an extract more concentrated in aromatics is obtained, which with special stripping procedure, yields nitration-grade aromatics. A flow sheet is given. O. P. Brysch

SUN OIL COMPANY AROSORB PROCESS FOR THE SEPARATION OF AROMATICS. *Petroleum Refiner*, 30, 227-230 (1951) September.

The Arosorb process of the Sun Oil Co. is to be incorporated in a new $8 million plant at Marcus Hook. The process is based upon the silica gel adsorption method, in which aromatics are selectively adsorbed from reformed naphthas. 13 million gal. benzene, 30 million of toluene and 15 million of xylenes will be produced annually. Process-cycle diagrams, flow sheets and pilot plant expenses are discussed. O. P. Brysch

TOLUENE GOES TO DEFENSE. *Chem. Week*, 47, 47, 48 (1951) September 22.

Toluene production is expected to rise to 200 million gallons annually in the next few years, the increase coming mainly from enlarged petroleum hydroforming operations. Currently, toluene derived from coke-oven operations and from petroleum are each some 3 million gallons per month. Military requirements are for aviation gasoline and for T.N.T.; biggest peace-time customer is the paint industry for solvents and thinners. C. H. Riesz

British Refinery

Guthrie, V. P. NEW ERA IN REFINING IN EUROPE. *Petroleum Processing*, 6, 992-996 (1951) September.

Construction of the Fawley refinery near Southampton reverses the policy of oil companies in England, who, prior to World War II, imported refined products. The 130,000 bbl. per day plant owned by Esso Petroleum Co., Ltd. (Standard of New Jersey affiliate) will be completed in 1953. C. H. Riesz

Catalyst Regeneration

Evans, L. P., Lee, R., and Hagerbaumer, W. A. (assigned to Socony-Vacuum Oil Co.) METHOD FOR REGENERATION OF MOVING CATALYSTS. U.S. 2,566,285 (1951) August 28.

A regeneration vessel for the removal of carbonaceous contaminants from 4- to 20-mesh catalyst particles is described. The catalyst is fed to the top of the vessel and gravitates downward as a substantially compact mass, passing through alternate burning and cooling zones. This arrangement permits the maintenance of practical burning rates in each zone, the temperature in each successive burning zone increasing as the contaminant composition changes. By removing the liberated heat, the cooling zones insure against overheating and damaging of the catalyst. Each burning zone contains a series of invented V-shaped troughs, which are connected either to the inlet distributor pipes or to the collector pipes which remove the products of combustion, and are positioned so as to provide for even distribution of the inlet air and the outlet gases. These troughs are made with a rounded apex, the side walls sloping at an angle of at least 75° with the horizontal. The apex eliminates dead space and sim-

plifies fabrication. The steep slope prevents the formation of stagnant catalyst zones above the troughs, and lessens the slowdown of flow of the catalyst in contact with the troughs, thus eliminating local overheating of the catalyst. Tests have shown that whereas a 60° slope trough permits stagnant zones and slowdown of flow which result in temperature difference at about 237° F. between the normal and low velocity catalyst zones, the corresponding temperature difference is only about 70° F. with a 75° slope trough. Therefore, this regeneration vessel permits complete regeneration without permanent heat damage to the catalyst.

J. J. Guyer

Mills, G. A. and Shabaker, H. A. FACTORS CONTROLLING AGING OF CRACKING CATALYSTS. *Petroleum Refiner*, **30**, 97-102 (1951) September.

Loss of catalyst activity may be temporary, such as that caused by coke deposits or nitrogen-compound deactivation, or the loss may be permanent, such as is attributed to high temperatures and steam deactivation. Heavy-metal impurities, such as vanadium, copper, nickel, and to a lesser extent, iron, cause a deterioration in catalyst selectivity, an index of carbon-production. Certain gases, in particular hydrogen sulfide, ammonia and sulfur dioxide, cause abnormally rapid aging of natural clay catalysts but not synthetic catalysts. Sulfur compounds present in the feed cause generally harmful aging of clays, but the total sulfur is not an accurate guide; sulfides cause rapid aging of clay but not synthetics, whereas thiophene and its homologs have little effect on either catalyst.

C. H. Riesz

Coal Hydrogenation

Kandiner, H. J., Hiteshue, R. W., and Clark, E. L. CATALYST EVALUATION AND MIDDLE OIL PREPARATION. PART II. *Chem. Eng. Progress*, **47**, 455-461 (1951) September: *Gas Abstracts*, **7**, 221 (1951) October.

The high pressure (7500 psig) coal hydrogenation pilot plant of the Bureau of Mines at Bruceton is described. Specific reference is made to operating features peculiar to high pressure small-scale operations of this type. Easy access service to all valves and packing in the compressor is emphasized; a satisfactory compressor valve design utilizes a synthetic rubber O-ring providing a seal even if small solid particles are present. It is suggested that high pressure castings for pumps and compressors be subjected to 100% radiographic inspection to detect faults. A treatment of contact time evaluation is presented. Methods are described for the correction of material balances to simulate recycle operation based on the experimental procedures employed.

C. H. Riesz

Desulfurization

Rosenwald, R. H. CHEMISTRY OF INHIBITOR SWEETENING. *Petroleum Processing*, **6**, 969-973 (1951) September.

Experimental data on the inhibitor sweetening of butyl mercaptans in cyclohexene are presented. A substituted phenylene diamine type of inhibitor and caustic were used in catalytic amounts. A mechanism of the reaction is proposed, and a description is given of the experimental apparatus and techniques employed.

C. E. Hummel

Fischer-Tropsch Synthesis

Baker, H. T. (assigned to Standard Oil Development Co.) HYDROCARBON SYNTHESIS. U.S. 2,560,325 (1951) July 10.

The synthesis activity of a fluidized bed of promoted iron catalyst is maintained at high levels by a daily interruption for treatment by a gas stream predominantly hydrogen in composition. The Fe_2C content of the catalyst is maintained above 20% while the oxygen content is kept below 15% by weight.

C. H. Riesz

Bremner, J. G. and Beaumont, S. (assigned to Imperial Chemical Industries Ltd., England). STABILIZATION OF PYROPHORIC METAL CATALYSTS UNDER FLUIDIZED CONDITIONS. U.S. 2,565,347 (1951) August 21.

Catalysts which are normally pyrophoric are deactivated by cooling reduced catalysts to below 140° F. and superficially oxidizing it by a mixture of oxygen and inert gas at temperatures below 140° F., all operations being conducted with the catalyst maintained as a fluidized bed.

C. H. Riesz

Clark, A. (assigned to Phillips Petroleum Co.) FISCHER-TROPSCH PROCESS FOR THE SYNTHESIS OF HYDROCARBONS. U.S. 2,564,958 (1951) August 21.

In a fluidized reactor for Fischer-Tropsch synthesis with iron catalyst, synthesis gas is introduced at a intermediate point in the reactor while recycle effluent gas is entered at the bottom of the reactor. The volume of the synthesis zone is from 5 to 15 times the volume of the reactivation zone; the space velocity of the fresh synthesis gas is 1500 to 3000 volumes/volume of reactor catalyst and the recycle space velocity is 2 to 4 times that of the fresh gas.

C. H. Riesz

Hemminger, C. E. (assigned to Standard Oil Development Co.) CATALYTIC CONVERSION PROCESS. U.S. 2,560,343 (1951) July 10.

In a fluidized reactor of the type used for catalytic cracking of hydrocarbons, the depth of the bed is varied by a change in the inlet position without shutting down the plant. By this means, the space velocity can be decreased to compensate for decrease in catalyst activity in use.

C. H. Riesz

Hemminger, C. E. (assigned to Standard Oil Development Co.) TWO STAGE HYDROCARBON SYNTHESIS OPERATION. U.S. 2,560,-344 (1951) July 10.

The catalytic hydrogenation of carbon monoxide is conducted in two stages. In the first stage, some 3-5% of water is added to direct the formation of oxygenated compounds. After separation of the products, the second stage is directed to hydrocarbon production. Process conditions are specified.

C. H. Riesz

Hemminger, C. E. (assigned to Standard Oil Development Co.) PRETREATMENT OF CATALYST FOR HYDROCARBON SYNTHESIS. U.S. 2,560,345 (1951) July 10.

Improved fluidized synthesis of hydrocarbons from carbon monoxide and hydrogen occurs when the iron catalyst is pretreated to form 20-25% by weight of Fe_2C. The rate of catalyst disintegration is appreciably lowered by the procedure described.

C. H. Riesz

Hill, L. R. (assigned to The M. W. Kellogg Co.) SYNTHESIS OF ORGANIC COMPOUNDS. U.S. 2,560,171 (1951) July 10.

A process for conducting fluidized synthesis of hydrocarbons from carbon monoxide and hydrogen is claimed. The recycling of effluent gases with hot separated catalyst is an essential feature.

C. H. Riesz

Hoekstra, J. (assigned to Universal Oil Products Co.) DEVICE FOR CONTROLLING THE LEVEL OF SUBDIVIDED SOLID PARTICLES WITHIN A CONTACTING CHAMBER. U.S. 2,559,876 (1951) July 10.

A device for controlling the level of a fluidized bed consists of a cup-shaped member having a solids inlet conduit on top and a perforated plate on the bottom as the solids outlet, the assembly being inserted at the top level of the fluidized bed.

C. von Fredersdorff

Kassel, L. S. (assigned to Universal Oil Products Co.) METHOD OF CONTROLLING EXOTHERMIC GAS REACTIONS. U.S. 2,566,-337 (1951) September 4.

Two liquid coolants are used in the synthesis of hydrocarbons from carbon monoxide and hydrogen. One is low-boiling and its vaporization at the reactor conditions absorbs the heat of synthesis. The second coolant is high-boiling and essentially dissolves heavy products of the reaction. The properties and amounts of the two coolants are defined.

C. H. Riesz

Keith, P. C., and Riblett, E. W. (assigned to Hydrocarbon Research, Inc.) HYDROCARBON SYNTHESIS. U.S. 2,564,696 (1951) August 21.

Loss or decrease of catalyst activity observed with continued use in the hydrogenation of carbon monoxide into higher hydrocarbons is overcome by continuous additions of alkali metal (e.g., potassium carbonate) to the catalyst by spraying or other means.

C. H. Riesz

Mayland, B. J. (assigned to Phillips Petroleum Co.) HYDROCARBON SYNTHESIS PROCESS. U.S. 2,564,985 (1951) August 21.

A fixed bed of iron catalyst is used to synthesize hydrocarbons from carbon monoxide and hydrogen. Water poisoning at the outlet portion is minimized by periodically (e.g., at 30-minute intervals) reversing the flow.

C. H. Riesz

Milligan, W. O., and Schiller, J. C. (assigned to Standard Oil Development Co.) PREPARATION OF A FISCHER-TROPSCH CATALYST. U.S. 2,567,296 (1951) September 11.

A method for stabilizing the gamma form of ferric oxide consists in adding an alkali metal in the amount of 1% to 15% by weight prior to reduction. The precautions taken to ensure the gamma rather than the alpha form of ferric oxide constitute the novelty of the claim. Patent 2,567,295 claims use of the catalyst for production of hydrocarbons and oxygenated compounds; Patent 2,567,296 claims its preparation as a catalyst for Fischer-Tropsch synthesis; Patent 2,567,297 claims its preparation as a catalyst.

C. H. Riesz

Hydrogenation

Engle, C. J. (assigned to Phillips Petroleum Co.) MANUFACTURE OF SATURATED HYDROCARBON MATERIALS. U.S. 2,564,964 (1951) August 21.

A process involving hydrogen transfer from a donor hydrocarbon, cis-decalin, to an olefin hydrocarbon is disclosed. A silica-alumina catalyst is used under specified conditions. Trans-decalin and commercial mixtures are less effective as donors.

C. H. Riesz

Fleming, H. W. HYDROGENATION AND HYDROGENOLYSIS. *Ind. Eng. Chem.*, **43**, 1978-1986 (1951) September.

Hydrogenation and hydrogenolysis publications appearing during 1950 are reviewed. Developments in the Fischer-Tropsch process include initial operation of the first American commercial plant at Brownsville, Texas, and disclosure of a nitrided iron catalyst. Selective hydrogenation of acetylene to ethylene and hydrogenation of catalytic recycle stocks and gas oils appear to have future industrial significance.

C. H. Riesz

Hydrocarbon Reactions

Haensel, V. and Sterba, M. J. PYROLYTIC AND CATALYTIC DECOMPOSITION OF HYDROCARBONS. *Ind. Eng. Chem.*, **43**, 2016-2022 (1951) September.

This review summarizes publications appearing in the literature during the twelve months preceding May, 1951. Use of deuterium as a tracer has improved understanding of reaction mechanisms. The production of acetylene by thermal cracking and the processing of Canadian bituminous sands have been considered industrially. Catalytic reforming production facilities for aromatic production have been materially expanded.

C. H. Riesz

Middle East Petroleum

Duff, D. M. PRODUCTION RECORD SET. *Oil Gas J.*, **50**, 56, 58 (1951) August 30.

The cut back in Iranian oil production has been compensated for by increased production in other areas. The production figures for June show an increase in world production of 24,000-bbl. daily. Half of this production was realized in the United States and half from other areas, principally Middle East sources other than Iran. These figures do not include recent developments, since Iran was not completely shut down in June.

W. G. Bair

IRAN THE LOSER? *World Oil*, **133**, 330-336 (1951) September.

Although Iran accounted for 6% of the world oil output last year, nationalization and subsequent loss of its crude production of 610,000 bbl./day has been redistributed through the efforts of the Foreign Petroleum Supply Committee, comprised of 19 American companies. Currently, a deficit of 150,000 bbl. per day is being met by withdrawals from above-ground storage, a situation which will change soon under proposed expanded production programs. A recent agreement concluded with Iraq may set the Middle East pattern: 50% of profits before taxes; retroactive benefits, gift of a re-

finery (24,000 bbl./day) to Iraqi government to refine low-cost crude for local consumption, minimum production quotas of 450,000 bbl./day to be met by 1954, option of crude or cash by the government.

C. H. Riesz

Recovery

Calhoun, J. C., Jr. THEORETICAL ASPECTS OF WATER FLOODING. *Oil Gas J.*, **50**, 308, 311-316 (1951) September 20.

This article presents a review and many brief discussions of the physical factors which effect or may effect the recovery of oil by water flooding. A bibliography of 28 references is included.

O. T. Bloomer

Shale Oil Fuels

Clark, E. L., Hiteshue, R. W., Kandiner, H. J. and Morris, B. HYDROGENATION OF SHALE-OIL COKER DISTILLATE. *Ind. Eng. Chem.*, **43**, 2173-2178 (1951) September.

A technically feasible method for converting shale oil into specification jet fuel and diesel fuel combines recycle coking and hydrogenation at 1500 psig over cobalt molybdate catalyst. Some 1500 gallons of liquid product was prepared in two hydrogenation runs, the product being distilled into a 60% overhead jet fuel material and 40% residue diesel fuel (55 and 60 cetane number). The overall liquid recovery is 75-78%; important amounts of ammonia and hydrogen sulfide are also produced.

C. H. Riesz

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Faber, W. F. APPARATUS FOR CONTINUOUSLY PRODUCING COMBUSTIBLE GAS. p. 242

Mayland, B. J. MANUFACTURE OF SYNTHESIS GAS. p. 243

Schutte, A. H. PROCESS FOR PRODUCING GAS FROM OIL. p. 242

7. ANALYTICAL METHODS AND TESTS

Analysis by Extraction

Golumbic, C. LIQUID-LIQUID EXTRACTION ANALYSIS. *Anal. Chem.*, **23**, 1210-23 (1951) September

The theory, method, present status, and applications of this convenient method of analysis are given. The author points out that actual isolation of components of a mixture is obtained, that no calibration data are required, and that the accuracy of the method is of the order of accuracy in spectroscopic analysis.

I. Ladany

Continuous Gas Sampler

McGlashen, W. A. and Powell, J. S. CONTINUOUS, AUTOMATIC SAMPLING OF FUEL GASES IN TRANSMISSION AND DISTRIBUTION SYSTEMS. *Gas*, **27**, 49-52 (1951) September

Representative samples of pipeline gas may be obtained using a specially designed gas pressure regulator between the gas source and the sample container. The regulator adjusting-screw is turned at a constant rate by a clock mechanism, permitting accumulation of the gas sample over the desired period of time. Samples are thus obtained at approximately one-fourth the cost of the usual daily "spot" method of obtaining similar samples. Detailed drawings and operating procedure of this equipment are presented.

C. E. Hummel

Equilibria in Analysis

Elving, P. J. ROLE OF HETEROGENEOUS EQUILIBRIA IN ANALYTICAL CHEMISTRY. *Anal. Chem.*, **23**, 1202-1209 (1951) September.

The various separation processes which form the basis of classical analytical chemistry are examined and are discussed in their relation to standard concepts of heterogeneous equilibria. The separation processes, considered in terms of the phase rule, include crystallization, volatilization, condensation, partition and extraction. Other analytical applications of heterogeneous equilibria are tests for purity and homogeneity, identification, and separation of trace constituents.

S. Katz

Fluid-Flow Measurement

Cowan, W. L. MEASUREMENT OF FLOW OF FLUIDS THROUGH ORIFICE METERS. *Instruments*, 24, 975-977 (1951) August.

Principles of Bernoulli's theorem as applied to measurement of flow of fluids through an orifice meter are carefully derived. The measured quantity is corrected to standard cubic feet at 14.73 psi and 60° F. as a reference point. Factors such as expansion, Reynold's number, gravitation, temperature, and super-expandibility are taken into consideration.

S. Mori

McClure, C. PIPE LINE FLOW EFFICIENCIES. *World Oil*, 133, 282-284, 288 (1951) September

A pipe line efficiency unit, equipped with measuring equipment, was organized to improve the efficiency of natural gas pipe lines. The measuring and cleaning procedures employed are discussed.

B. E. Hunt

Gas Analysis

Hebler, W. O. GAS ANALYSIS APPARATUS. U.S. 2,565,230 (1951) August 21.

An electrical circuit is described which eliminates the need for sealing up a reference gas in a thermal-conductivity type gas analyzer.

D. V. Kniebes

Nitrogen in Coal

Badami, G. H., and Whitaker, J. W. DETERMINATION OF NITROGEN IN COAL. *Fuel* (British), 30, 211-212 (1951) September

In the Kjeldahl method of nitrogen determination, acceleration of the procedure can be had by addition of oxidizing agents. The correct conditions for the improved method consists of boiling the sample for 5 minutes in acid before addition of permanganate, followed by 20 minutes of boiling after the solution has cleared. Agreement with the standard method is within 0.03% N, and the time for one determination is 1 hour.

J. Ladany

Particle Size Measurement

Ivey, F. E., Jr. THE PARTICLE SIZE ANALYSIS OF FLUID CRACKING CATALYSTS. PART III. *Petroleum Refiner*, 30, 127-132 (1951) September

In the third part of this series the author describes "the best method we have seen to date for determining accurately the particle size analysis of our fluid type petroleum catalysts." By the use of the compacted density and by correcting for adsorption of water during elutriation, the Density Ratio was derived to relate the particle diameter by screen analysis to that by elutriation (Roller). The modified Roller method is described. The statistical analysis and the conclusions as to precision of screen and elutriation methods are tabulated. (For Parts I and II see *Gas Abst.*, 7, 191 (1951) September).

O. P. Brysch

Weighing

Duval, C. CONTINUOUS WEIGHING IN ANALYTICAL CHEMISTRY. *Anal. Chem.*, 23, 1271-1286 (1951) September.

A continuously recording microbalance for samples whose weight undergoes a change with time is described. The weight charge is calibrated on a recording chart and an accuracy of .003 mg. can be obtained. The sample can also be enclosed in a furnace, heated to any desired temperature, and thermostated; thus one can obtain a rate of reaction of the sample from the recorder at this temperature. The balance beam is suspended on two pairs of tungsten wires instead of resting on a conventional knife edge, to increase its life of high sensitivity.

S. Mori

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Ilfeld, R. M. MOISTURE IN GASES BY AUTOMATIC DEW POINT EQUIPMENT. p. 261

Munch, R. H. NEW INSTRUMENT FOR AIR POLLUTION STUDIES. p. 261

Murphy, E. A. PRESSURE AND VACUUM GAGES. p. 262

White, C. E. NEW INSTRUMENT TO DISCLOSE ODOR CONCENTRATION LEVELS IN GAS. p. 246

8. GENERAL AND PHYSICAL CHEMISTRY

Adsorption Research

Aston, J. G. and Mastrangelo, S. V. THE ANOMALOUS FIRST LAYER OF ADSORBED HELIUM AND A MODIFIED B.E.T. THEORY. *J. Chem. Physics*, **19**, 1067-8 (1951) August.

Evidence presented shows that the first completed B.E.T. "monolayer" may have an anomalous density. It is indicated that the early adsorption occurs in patches of multilayers. The B.E.T. energy assumptions are modified to explain the first "multilayer."

C. H. Riesz

Morrison, J. A. and Drain, L. E. THE HEAT CAPACITY OF MULTIMOLECULAR LAYERS OF ADSORBED ARGON. *J. Chem. Physics*, **19**, 1063 (1951) August.

The heat capacity of argon adsorbed on rutile at low temperature has been measured. Maxima were observed which moved to higher temperatures with increasing layers of adsorbent. These phenomena are interpreted as indicating rearrangement in adsorbed films equivalent to fusion in the bulk substance. The onset of bulk properties occurred at approximately two layers.

C. H. Riesz

INFLUENCE OF A CHEMISORBED FILM ON SUBSEQUENT PHYSICAL ADSORPTION PROCESSES. *Nature* (British) **168**, 433-434 (1951) September 8.

The adsorption properties of a reduced, alkali-promoted iron catalyst (Fischer-Tropsch synthesis catalyst) were examined. Three types of surfaces were detected.

C. H. Riesz

Ammonia Explosions

Hughes, T. R. MYSTERIOUS AMMONIA EXPLOSIONS. *Refrigerating Eng.*, **59**, 859-862, 914 (1951) September.

The author cites several examples of ammonia flash fires and explosions, and emphasizes the fact that ignition occurs at much lower temperatures than those experimentally determined in the laboratory with mixtures of pure ammonia and air within the explosive limits. On the other hand, several breaks in refrigerating systems have resulted only in loss of clean ammonia, although local high-temperature spots equivalent to those which caused flash fires on explosions were present. Thus the presence of a foreign agent seems to be required for flash fires of explosions to take place. Several precautionary measures are listed.

J. J. Guyer

Ammonia Synthesis Catalyst

Brill, R. THE RATE EQUATION OF AMMONIA SYNTHESIS ON IRON-TYPE CATALYSTS OF DIFFERENT COMPOSITION. *J. Chem. Physics*, **19**, 1047-1050 (1951) August.

Investigations show that the rate equations for ammonia synthesis on iron catalyst are the same for three catalysts—(1) pure iron, (2) iron promoted by 3% alumina and 2% potassium oxide.

C. H. Riesz

Diffusion

Whalley, E. THE EFFECT OF THERMAL DIFFUSION ON PHYSICO-CHEMICAL MEASUREMENTS. *Trans. Faraday Soc.*, (British) **47**, 815-826 (1951) August.

If a system is under a temperature gradient, the concentrations of the mixture at one end of the system may vary from the other due to differences in thermal diffusivities of each component. Methods whereby the concentration differences may be lessened are discussed, and equations are obtained for calculating the concentration gradient at various parts of a binary flow system in the case where the diffusion is unidirectional. Multicomponent systems are discussed only qualitatively, since the calculations are quite complex for a unidirectional system.

S. Mori

Flame Research

Hirschfelder, J. O. and Curtiss, C. F. THE THEORY OF FLAME PROPAGATION. *J. Phys. Colloid Chem.*, **55**, 774-788 (1951) June.

A mathematical analysis of the factors controlling flame propagation has been set up as a steady state solution of the one-dimensional

flame equation. From this solution and experimental data, hypotheses stated here can be tested. These hypotheses include the hydrodynamical equations for a compressible gas mixture including diffusion, heat conductivity, and an arbitrary system of chemical kinetics.

D. L. Nicol

Hilsch Separator

MODIFIED HILSCH APPARATUS FOR PRODUCING HOT AND COLD AIR STREAMS. *J. Sci. Instr.*, 28, 251 (1951) August.

The operation of one form of Hilsch apparatus for separating a stream of air into hot and cold streams is described. Experimental methods of analyzing the mechanism of the effect are described.

S. Katz

Hydrocarbon Properties

Benedict, M., Webb, G. B., and Rubin, L. C. AN EMPIRICAL EQUATION FOR THERMODYNAMIC PROPERTIES OF LIGHT HYDROCARBONS AND THEIR MIXTURES. CONSTANTS FOR TWELVE HYDROCARBONS. *Chem. Eng. Progress*, 47, 419-422 (1951) August.

Constants for the Benedict-Webb-Rubin equation of state for the following 12 hydrocarbons are given:—methane, ethylene, ethane, propylene, propane, iso-butane, iso-butylene, n-butane, i-pentane, n-pentane, n-hexane and n-heptane. The equations for calculating thermodynamic properties (enthalpy, entropy and fugacity) of these hydrocarbons and their mixtures are also given. A separate set of constants,—to evaluate the subatmospheric vapor pressure of hydrocarbons,—is listed. At densities up to 1.8 above the critical, the average absolute deviation of gas-phase pressures predicted by this equation of state is 0.46%. 41 references are given.

D. C. Gami

Isotope Applications

Emmett, P. H. RADIOISOTOPES. *Oil Gas J.* 50, 82, 84, 87-93 (1951) September 27.

Proposed uses for radioactive isotopes in the petroleum industry are reviewed. Applications in exploration, drilling, refining, distribution, testing and research are discussed.

C. H. Riesz

Kinetics and Equilibria

Wilhelm, R.. H. and Toner, R. K. KINETICS AND EQUILIBRIA. *Ind. Eng. Chem.*, 43, 1898-1907 (1951) September.

This article is an annual feature summarizing recent contributions to and the current status of chemical kinetics and equilibria. Treating kinetics first, the paper begins with a brief review of new books. Next follows a description of rate process theory. The subject of very fast reaction, including combustion, was a major field of endeavor, and work in heterogeneous systems, especially those involving catalysis, were especially prominent. A section on methods of performing reactions includes consideration of flow system, stirred tank reactions and fluidized beds. Considerable theoretical development has been described in connection with transport phenomena, heat and mass transfer, momentum transfer, and a number of reaction systems are discussed in which diffusion appears to predominate. A total of 135 references are cited. In the field of chemical equilibria, reference is made to current books and review papers. Reference is made to publications by Sage and by Sage and Lacey on the thermodynamics of light paraffin hydrocarbons. Following reviews of electrochemistry, metallurgy and ion exchange, a number of unclassified reactions are discussed, including some interesting views on equilibria in water gas systems. References are made to methods of computing equilibria in complex systems, and the second virial coefficients for a number of elementary hydrocarbons were studied. 83 references are listed.

S. Katz

Permeability and Adsorption

Barrer, R. M. and Grove, D. M. FLOW OF GASES AND VAPOURS IN A POROUS MEDIUM AND ITS BEARING ON ADSORPTION PROBLEMS. PART I—THE STEADY STATE OF FLOW. *Trans. Faraday Soc.*, (British) 47, 826-837 (1951) August.

This paper describes a study of steady state flow of He, Ne, A, Kr, H_2, O_2, N_2, NH_3, CCl_4

and SO_2 through a packed bed of spherical granules. Flow rates, gas permeabilities, streamline and molecular flow effects, and permeability constants were determined and applied to several flow equations. Deviation from the flow equation of Adzumin and Arnell are significant, and in one case, that of NH_3, the possibility of surface diffusion was proposed.

S. Katz

Barrer, R. M. and Grove, D. M. FLOW OF GASES AND VAPOURS IN A POROUS MEDIUM AND ITS BEARING ON ADSORPTION PROBLEMS. PART II. TRANSIENT FLOW. Trans. Faraday Soc., (British) 47, 837-844 (1951) August.

The time lag required to establish steady state flow conditions may be used to measure the diffusion coefficient of gases in a porous medium. This may in turn be used to compute a mean pore radius and a total surface area. In an inert packed bed, it was found that the permanent gases, the inert gases and CCl_4, show little adsorption at low pressures, but NH_3 and SO_2 show strong adsorption.

S. Katz

Jones, W. M. MOBILITY IN A SORBED LAYER. PART I.—THE FLOW OF GASES AND VAPOURS THROUGH POROUS MEDIA. *Trans. Faraday Soc.*, (British) 47, 381-392 (1951) April.

A gaseous system may be treated as an idealized two-dimensional gas to describe its flow through a porous medium. The resulting equation is applied to a number of experimental systems. It is concluded that, in addition to the effects related to streamlined and molecular flow through fine capillaries which appear in most flow equations, a term for gas flow past capillary surfaces is required.

S. Katz

Wilson, L. H., Sibbitt, W. L., and Jacob, M. FLOW OF GASES IN POROUS MEDIA. *J. Appl. Physics*, 22, 1027-1030 (1951) August.

This paper presents a brief theoretical review of the viscous, the free molecular, and the transition (or viscous slip) flow phenomenon in porous media. The equations which describe these two types of flow are combined to yield a semi-empirical equation which can be applied for the viscous, and free molecular, as well as the transition flow region. Experimentally determined limiting values of the ratio of molecular mean free path to pore diameter are reported. These ratios may be used to indicate the nature of flow in porous media if pore size is known or they may be used to determine pore size experimentally. Abstractor's Note: The phenomena of viscous slip, and free molecular flow of gases in porous media was first called to the attention of the gas and petroleum industry by Klinkenberg in 1941, and is now generally known as the Klinkenberg effect. The development presented here is essentially the same as that of Klinkenberg. O. T. Bloomer

Phase Equilibria

Beattie, J. A., Levine, S. W. and Douslin, D. R. THE VAPOR PRESSURE AND CRITICAL CONSTANTS OF NORMAL PENTANE. *J. Am. Chem. Soc.*, 73, 4431, 4432 (1951) September.

The vapor pressure of normal pentane, C_5H_{12}, has been measured from 100° C. to the critical point. The results are represented quite well by the relation:

$$\log_{10} p = 3.752453 - (1225.960/T) + 8.06841(10^{-4})T$$

$$T = t°C. + 273.16, \text{ and } p. = \text{atm.}$$

The critical constants were determined by compressibility measurements in the critical region, and were found to be $t_c = 196.62 \pm 0.05°$ (Int.); $p_c = 33.31 \pm 0.05$ normal atm.; $v_c = 0.295$ liter/mole (4.09 m./g.); $d_c = 3.39$ moles/liter (0.244 g./ml.). The uncertainty in the critical volume and density is 1%.

Authors' Abstract

Dean, M. R. and Pettmann, F. H. PHASE BEHAVIOR OF HYDROCARBON SYSTEMS. *Petroleum Engr.*, 23C, 18, 21, 24-28 (1951) September.

The apparatus used at Phillips Petroleum Co. to study the phase behavior of hydrocarbon systems at high pressure (up to 10,000 psia) is described. Two equilibrium cells are used, one designated as the "PVT cell", and the other as the "piston cell". The piston cell has a volume of 2700 cc and is equipped for the accurate measurement of small quantities of liquid. Pro-

vision is also provided for total removal of liquid and vapor samples. The procedure for obtaining dew and bubble point data by graphical analysis of liquid volume-pressure data is illustrated at two temperatures for the ethylene, n-butane system. No other experimental data is presented. Some equipment details are given, and calculation procedures are outlined.

O. T. Bloomer

Hoge, H. J. and Arnold, R. D. VAPOR PRESSURES OF HYDROGEN, DEUTERIUM, AND HYDROGEN DEUTERIDE AND DEW-POINT PRESSURES OF THEIR MIXTURES. *J. Research Nat. Bur. Standards*, **47**, 63-74 (1951) August.

The vapor pressures of H_2, HD, and D_2 have been measured from near their triple-points to their critical points. The H_2 and D_2 samples were catalyzed to ortho-para equilibriums at 20.4°K. Tables suitable for interpolation have been prepared to represent the results, both in centimeter-gram-second and in engineering units. Measurements of dew-point pressures of several binary mixtures have been made at several pressures below atmospheric. Observed pressures were about 3% above those predicted by the law of ideal solutions.

Authors' Abstract

Hoge, H. J. and Lassiter, J. W. CRITICAL TEMPERATURES, PRESSURES, AND VOLUMES OF HYDROGEN, DEUTERIUM, AND HYDROGEN DEUTERIDE. *J. Research Nat. Bur. Standards*, **47**, 75-79 (1951) August.

The critical temperatures, pressures and volumes of H_2, HD, and D_2 have been determined by measuring short sections of P-V isotherms in the neighborhood of the critical points. The H_2 and D_2 samples were catalyzed to ortho-para equilibrium at 20.4°K and are designated e-H_2 and e-D_2. For e-H_2 the values found are $Tc = 32.9_{94}$°K, $Pc = 12.7_{70}$ atm, and $Vc = 65.5$ cm^3mole^{-1}. For HD the corresponding values are 35.9_{08}° K, 14.6_{45} atm, and 62.8 cm^3 $mole^{-1}$. For e-D_2 the values are 38.2_{62}° K, 16.2_{82} atm, and 60.3 cm^3mole^{-1}. A method of correlating isotherm data for different substances, based on the use of graphs of log P versus log V, is described.

Authors' Abstract

Mayer, J. E. NOTE ON THE THEORY OF CRITICAL PHENOMENA. *J. Chem. Phys.*, **19**, 1024-1027 (1951) August.

Zimm's theoretical considerations of the preceding paper are compared with the earlier conclusion of this author. Some of the conclusions which must be drawn if one is not to accept Zimm's conclusions are pointed out. It appears that Zimm's conclusions are at least as plausible as this author's earlier hypotheses.

Author's Abstract

McKay, R. A., Reamer, H. H., Sage, B. H. and Lacey, W. N. VOLUMETRIC AND PHASE BEHAVIOR IN THE ETHANE-PROPENE SYSTEM. *Ind. Eng. Chem.*, **43**, 2112-2117 (1951) September.

The molal volume of three mixtures of ethane and propene was measured at pressures up to 10,000 psi in the temperature interval between 10° and 400° F. The composition of the coexisting phases was established throughout the two-phase region of this system at temperatures above 10° F.

O. T. Bloomer

Zimm, B. H. CONTRIBUTION TO THE THEORY OF CRITICAL PHENOMENA. *J. Chem. Phys.*, **19**, 1019-1023 (1951) August.

If one considers the critical point between the liquid and gaseous phases, it may be shown that the "principle of superposition" leads to the result that the critical point is a singularity in the isotherm of fugacity or pressure against density. At this singularity the derivatives of every order of the fugacity or pressure with respect to the density are zero, not only the first two derivatives as in the van der Waals theory. It is postulated that these relations are true despite the uncertain nature of the superposition approximation. If the critical point is such a singular point, it can be shown that Mayer's theory of critical phenomena leads quite reasonably to a single characteristic temperature, instead of two separate temperatures, for the vanishing of the slope of the isotherm and for the appearance of a surface tension. Experimental observations on the anomalous shape of the isotherms near the critical point are in accord with the theory.

Author's Abstract

Photo Absorption

Penner, S. S. and Weber, D. EMISSION OF RADIATION FROM DIATOMIC GASES. II. EXPERIMENTAL DETERMINATION OF EFFECTIVE AVERAGE ABSORPTION COEFFICIENTS OF CO. *J. Appl. Physics*, **22**, 1164-1167 (1951) September.

Empirical evidence obtained for CO at room temperature, which supports the use of average absorption coefficients for entire vibration-rotation bands, is examined. In Sec. II, the existence of an average apparent absorption coefficient for data obtained with inadequate spectral resolution is demonstrated. In Sec. III, semi-quantitative evidence at elevated total pressures and small optical densities for the use of a constant absorption coefficient equal to the ratio of integrated absorption to effective band width is described. These results serve as direct support for a proposed simplified method for radiant-heat-transfer calculations.

Authors' Abstract

Pyrometry

Corruccini, R. J. ANNEALING OF PLATINUM FOR THERMOMETRY. *J. Research Nat. Bur. Standards*, **47**, 94-103 (1951) August.

A study of optimum annealing temperatures of platinum wire for thermometry indicated that for pure metal, effective annealing is achieved at about 700° C. Rapid cooling may contribute to reduce the effectiveness of the heat treatment. The effect of various noble metal impurities on the electrical properties of platinum are discussed. A kinetic expression for the rate of annealing is derived.

S. Katz

Jackson, R. TEMPERATURE MEASUREMENT IN GASES AND FLAMES—RADIATION METHODS. *Brit. Coal Utilization Research Assoc. Monthly*, **15**, 205-219 (1951) June.

This article presents a review of radiation methods for temperature measurement. The principle discussions concern the theory of the optical pyrometer and the line reversal methods, with particular reference to the sodium line reversal method for the determination of flame temperature. A bibliography of 63 articles is given.

E F. Searight

Machler, R. C. (assigned to Leeds and Northrup Co.) HIGH-TEMPERATURE-MEASURING SYSTEM. U.S. 2,565,249 (1951) August 21.

This patent describes a pyrometer with an open end for immersion below the surface of molten metal. Temperature measurement is made under black-body conditions. Details of the optical and recording system are given.

S. Katz

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Lewis, B. COMBUSTION. p. 235

Wilson, C. W. BLOWOFF OF FLAMES FROM SHORT BURNER PORTS. p. 235

9. ORGANIC CHEMISTRY

Aromatic Dealkylation

Berg, L., Kindschy, E. O., Reveal, W. S., and Saner, H. A. ALUMINA ACTIVATED WITH ANHYDROUS HYDROGEN FLUORIDE. *Chem. Eng. Progress*, **47**, 469-472 (1951) September.

Alumina activated with hydrogen fluoride at 752° F. was used to dealkylate ethyl, isopropyl and amyl side chains from aromatic hydrocarbons at atmospheric pressure and 800-940° F. Benzene was the ultimate dealkylation product if the side chains contained two or more carbon atoms. With xylenes, toluene was formed as the ultimate dealkylation product, but alkylation to trimethyl benzene was also observed.

C. H. Riesz

Butadiene Purification

Morrell, C. E. and Swaney, M. W. (assigned to Standard Oil Development Co.) REMOVING ACETYLENES FROM HYDROCARBON MIXTURES AND IMPROVEMENTS IN THE SEPARATION OF BUTADIENE AND ACETYLENES. U.S. 2,566,135; 2,566,136; 2,566,137 (1951) August 28.

In the purification of diolefins (butadienes) from the products of petroleum cracking, the ethyl acetylene and vinyl acetylenes usually present are first removed with the butadiene from the butenes by extracting the C_4 cut at 0°

C. with alkaline cuprous acetate solution. The solution, when heated to 70° C. under pressure gives conversion of the dissolved acetylenes to harmless heavy polymers. This heating may be conducted in a pressure distilling column with heavy reflux of cold, rich solution to wash the flashed-off butadiene. The polymers may be filtered, decanted and extracted cyclically by solvents from the lean copper solution.

O. P. Brysch

Ethylene Chemicals

Ghosh, J. C. and Das Guha, S. R. CATALYTIC DEHYDROCHLORINATION OF ETHYLENE DICHLORIDE. *Petroleum* (British) **14**, 261-264 (1951) October.

The dehydrochlorination of ethylene dichloride yielded 88% of vinyl chloride at 932° F. through use of 10% SnO_2:$FeCl_2$ on activated charcoal. Five other catalysts tested were less active.

C. H. Riesz

Kuhn, W. E. and Hutcheson, J. W. ETHYLENE CHEMICALS—THE NEXT DECADE. *Chem. Week*, **69**, 19-31 (1951) September 29.

The chemicals and products derived from ethylene are each considered and estimates made as to production 10 years from now. While 25% of all chemicals now made in this country are petrochemicals, by 1952 the figure should be close to 50%. It is predicted that the present $2 billion petrochemical investment will quadruple. A comparison between petroleum refining and petrochemical manufacture indicates difficulties because of high investment cost, large-scale ethylene production plants, high utility requirements, increasing raw material costs, high transportation costs and large research expenditures. Research expenditures on chemicals are now in excess of $100,000,000 annually, about 2.2% of total chemical sales.

C. H. Riesz

Ethylene Recovery

Gardner, C. R. (assigned to Phillips Petroleum Co.) SELECTIVE CONVERSION OF ALKYNE HYDROCARBONS. U.S. 2,564,278 (1951) August 14.

A process is described for removing acetylene from a gas stream without affecting the ethylene content. Steam in the amount of approximately 4 moles per mole of acetylene is added, and reacted with the acetylene to form mainly acetaldehyde at a temperature of about 625° F. in the presence of a copper pyrophosphate catalyst supported on an inert carrier. C. H. Riesz

Oxygenated Chemicals

Marek, L. F. OXIDATION. *Ind. Eng. Chem.*, **43**, 1990-2006 (1951) September.

This is a review of the literature on this subject over the past year. The subjects reviewed are oxidation of aliphatic and aromatic hydrocarbons, organic compounds, carbon, rubber, transformer oils, drying oils, and production of peroxides. References to kinetics and oxidation of a number of miscellaneous compounds are included. The conversion of hydrocarbons to useful organic compounds is singled out for attention because of the present peak of application and the great future prospects. 40% of organic chemical production today stems from crude oil and natural gas hydrocarbons.

C. L. Tsaros

Phenol Synthesis

NOW, PHENOL FROM CUMENE. *Chem. Week*, **69**, 23-24 (1951) August 25.

In two new plants to be erected, one in the United States and one in Canada, a new method of making phenol from benzene is to be used. Benzene is first alkylated with propylene to produce cumene (isopropylbenzene), then the cumene is oxidized with air in the liquid phase to form the hydroperoxide, and finally the hydroperoxide is boiled with acid to yield phenol and acetone. The new process requires neither chlorination or sulfonation, an advantage since both chlorine and sulfur are in short supply at present.

C. H. Riesz

Phthalic Anhydride

NEW PHTHALIC SOURCE. *Chem. Week*, **69**, 20 (1951) August 25.

Studies now being completed by the British Coal Utilization Research Association show that phenanthrene can be oxidized to form phthalic anhydride. Sodium-vanadium pentoxide microspheres are used as the catalyst in a fluidized bed. Phenanthrene, a major constituent of anthracene cake formed in the fractionation of coal tar, has had only minor uses in the past.

C. H. Riesz

10. CHEMICAL ENGINEERING

Ammonia Economics

Tallman, R. C. ECONOMICS OF AMMONIA PRODUCTION IN THE SOUTHWEST. *Ind. Eng. Chem.*, 43, 1753-1766 (1951) August.

The Ozark Ordnance Works at El Dorado, Ark., was built and operated by the Lion Oil Co. for production of nitrates and ammonia for the war effort. At the end of World War II its value in helping to fill the demand for agricultural nitrogen in the Southwest was obvious. A market survey of the area resulted in the leasing and finally the purchase of the plant from the Government. A review of the present status of the over-all nitrogen economy with suggestions as to its future developments is included.

Author's Abstract

Cooling Water

Degler, H. E. COOLING TOWERS AND AIR-COOLED EXCHANGERS. *Oil Gas J.* 50, 76-80 (1951) September 6.

During the past 40 years methods of cooling water have been used in the following sequence: (1) rivers, lakes, and wells; (2) spray ponds; (3) evaporative condensers; (4) natural-draft water-cooling towers; (6) induced-draft cooling towers; and (7) air-cooled exchangers. The principles of evaporative cooling are briefly discussed and cooling towers are described. Comparison is made between cooling tower-heat exchanger combinations and the increasingly used air-cooled exchangers. Recommendations for operation and maintenance are given.

C. L. Tsaros

Extraction

Gallo, S. G., and Hartvigsen, H. V. (assigned to Standard Oil Development Co.) COUNTER-CURRENT EXTRACTION TOWER. U.S. 2,562,783 (1951) July 31.

Two arrangements of liquid-liquid extraction towers are described. The features of both are the use of rotating paddles or propellors to import a tangential swirl to the liquid, which causes the descending and ascending liquids to travel in a helical path through the tower. Vertical wire screws or grids are positioned in the tower in alternate position to the agitators in order to cause redispersion of the two liquids. Contact time and maximum throughput of the tower can be controlled by varying the speed of the agitation, which in turn controls the velocity of the horizontal component.

C. L. Tsaros

Gas-Liquid Contactor

Bloomer, W. J. (assigned to Centrifix Corp.) FIXED CENTRIFUGAL DEVICE. U.S. 2,560,071 (1951) July 10.

The patent relates to a fixed centrifugal device having a series of tangential blades which form narrow passages for contacting liquids and gases.

C. von Fredersdorff

Heat Transfer

Davies, G. F. HEAT TRANSFER COEFFICIENTS. *Chem. Eng.* 58, 122-124 (1951) August.

An outline is given of quick methods of estimating overall heat-transfer coefficients when an "order-of-magnitude" figure is needed. The method is very approximate and cannot be used in final design calculation.

W. G. Bair

Evans, S. K., and Sarjant, R. J. HEAT TRANSFER AND TURBULENCE IN GASES FLOWING INSIDE TUBES. *J. Inst. Fuel* (British), 24, 216-27 (1951) September.

Convection and radiation heat-transfer coefficients were determined under conditions of viscous, turbulent, and calmed turbulent flow in a water-cooled test section operating with air and flue gases up to 1600° F. It is shown that the convective coefficients for turbulent flow follow the McAdams equation:

$$Nu = a\,(Re)^{0.8}$$

where Nu is the Nusselt number
a is an experimental constant
Re is the Reynolds number.

A correlation is given relating pressure drop and convective heat-transfer coefficient based on the classical Prandtl equation. Combined radiation and convective coefficients followed the relationship

$$h_{cr} = AG^{0.8}$$

where h_{cr} is the combined radiation and convection coefficient
A is a constant
G is the mass velocity

Turbulence promoters increased the convective coefficient, but caused an undesirably high pressure-drop. The most efficient turbulence promoter was found to be a spirally-wound section inserted in the test section. The inaccuracies in the present equations for predicting the convective coefficient under streamline flow is discussed. A detailed summary of data and graphical correlations are included. 41 references are given. C. von Fredersdorff

Koble, R. A., Ademino, J. N., Bartkus, E. P. and Corrigan, T. E. NEW DATA FOR HEAT TRANSFER TO FLUIDIZED SOLIDS. *Chem. Eng.*, 58, 174-178 (1951) September.

Heat transfer coefficients obtained by flowing pulverized solids through an externally heated pipe section varied from 45 to 75 Btu/hr./sq.ft./° F. and the data for coal were correlated by the equation. $U = 0.32\ G^{0.39}$ where U is the heat transfer coefficient in Btu/hr./sq. ft./° F., and G is the solids mass velocity in M lb./hr./sq.ft. C. von Fredersdorff

Mixer Design

Rushton, J. H. THE USE OF PILOT PLANT MIXING DATA. *Chem. Eng. Progress*, 47, 485-489 (1951) September.

The use of pilot plant mixing data for the design of large-scale equipment is discussed. Basic fluid mechanical equations and concepts are presented. J. D. Parent

Pebble Heaters

Goins, R. R. (assigned to Phillips Petroleum Co.) PEBBLE HEATING CHAMBER. U.S. 2,565,809 (1951) August 28.

Improvements in the design of pebble heat exchangers to obtain uniform pebble and gas flow by a system of baffles and distributors are suggested. C. von Fredersdorff

Sulfur Production

FRASCH STILL KING. *Chem. Week*, 69, 19 (1951) September 22.

Current estimates of the production of sulfur are given for the years 1951, 1952 and 1953. A summary of the various sulfur sources (including sulfur from hydrocarbon gases) and the extent of their contribution are presented. C. E. Hummel

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Air Analyzer

Munch, R. H. INSTRUMENTATION. A NEW INSTRUMENT DESIGNED FOR AIR POLLUTION STUDIES IS SENSITIVE TO 0.05 PART PER MILLION OF SULFUR DIOXIDE. *Ind. Eng. Chem.*, 43, 99A-102A (1951) September.

This instrument, designated the Thomas Autometer, is now being manufactured. An air sample is passed countercurrent to a sulfuric acid-hydrogen peroxide reagent. Oxidation of the sulfur dioxide to sulfuric acid causes increased electrolytic conductivity of the reagent, which is measured by the instrument. The pressure of carbon dioxide in the air does not interfere, but sulfur trioxide, hydrogen chloride, and oxides of nitrogen cause high readings. Determinations are reproducible to 0.1 part per million. C. E. Hummel

Combustion Air Meter

McChesney, I. G. AIR METERING FOR COMBUSTION CONTROL. *Combustion*, 23, 44-47 (1951) August.

A combustion air meter should require sufficient head to operate a control pilot, and should require a pressure differential which will remain proportional to the square of the air flow over the whole range of boiler operation. Draft loss is an unsatisfactory measure because it is not proportional to the square of gas flow for a number of reasons, which are listed. The only advantage is that no power is consumed. The orifice meter is rejected on the ground that it will not maintain a constant flow pattern over a wide range of furnace operation. A streamlined air coil placed in the air duct was designed and construction details are described. The efficiency of this meter is 82% compared with 62% for an orifice meter. C. L. Tsaros

Dew Point Recorder

Ilfeld, R. M. DETERMINATION OF MOISTURE IN GASES BY AUTOMATIC DEW POINT EQUIPMENT. *Anal. Chem.*, 23, 1086-1089 (1951) August.

Description, limitations, and applications of a

continuous dew point recorder is reviewed in this article. The gas temperature may range from ambient room to -90° F. In industrial applications, a contact switch on the recorder may actuate a controlling mechanism when the maximum tolerable humidity for the process is reached.

S. Mori

Ore Reduction

Robiette, A. G. (assigned to John Miles and Partners, London) SMELTING OF IRON AND STEEL. U.S. 2,564,233 (1951) August 14.

A low shaft-furnace of height less than other dimensions, blown with a blast of 50 psi of at least 70% oxygen, is claimed for smelting iron ores, whereby weaker coke or non-coking coals may be used to carry the burden. Pre-reduction of the ore may be practised by utilizing the high CO-content top gas.

O. P. Brysch

Oxygen Production

De Baufre, W. L., Lincoln, Nebr. PROCESS AND APPARATUS FOR EXTRACTING OXYGEN FROM ATMOSPHERIC AIR. U.S. 2,568,223 (1951) September 18.

An oxygen plant which can be operated at relatively low compressed air pressures (75 to 150 psig) is claimed, which utilizes the same pressure drop, both for expansion to obtain refrigeration, and for heat transfer in rectifications. For efficient operation, the rectification is designed to recover as much oxygen as possible from the compressed air. A final rectifier uses oxygen-product as reflux vapor by vaporizing it in a heat exchanger to form liquid nitrogen, which then is used as reflux liquid in a preliminary rectifier where partly liquefied air is being separated.

O. P. Brysch

Pipe Locator

Eggleston, H., Jr. OPERATING PRINCIPLES OF PIPE LOCATOR. *Gas* 27, 40-44 (1951) September.

The principles and techniques of operation for using a pipe locator to locate buried pipes and metallic structures is described.

B. E. Hunt

Pressure Measurement

Kaplan, W. and Bellmann, D. J. IMPROVING REFINERY PROCESSING. *Oil Gas J.*, **50**, 319-326 (1951) September 20.

The use of differential pressure recorders in refinery operations is discussed. The instrument indicates tower flooding by a marked pressure increase and has high sensitivity. Applications to bubble-cap columns, absorbers and scrubbers are outlined.

W. G. Bair

Murphy, E. A. PRESSURE AND VACUUM GAUGES. *Southern Power & Ind.*, **69**, 65-76 (1951) September.

A discussion of types of pressure and vacuum measuring elements, and maintenance is given.

J. J. Guyer

Pump Seals

Rankin, D. R. MECHANICAL SEALS FOR CENTRIFUGAL PUMPS. *Petroleum Engr.*, **23C**, 13-16 (1951) September.

The article discusses mechanical seals vs. packing for centrifugal-pump shafts. The author favors mechanical seals, which have become increasingly popular within the last ten years. Mechanical seals at present are limited to temperature ranges below 250° F. for ordinary materials and to 450° F. with the use of Teflon. Pump designs using packing glands are usually not successfully converted to mechanical seals. The author feels that mechanical seals can be refined until they will have applications to all pumping requirements.

W. G. Bair

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Alter, A. C. HOW SOUTHERN CALIFORNIA EMPLOYS TELEMETERING AND REMOTE CONTROL. p. 246

Jackson, R. TEMPERATURE MEASUREMENT IN GASES AND FLAMES. p. 258

Cowan, W. L. MEASUREMENT OF FLOW OF FLUIDS THROUGH ORIFICE METERS. p. 253

Machler, R. C. HIGH TEMPERATURE MEASURING SYSTEM. p. 258

Masheter, W. L. PRESSURES TELEMETERED ON BIGGEST INCH. p. 246

McClure, C. PIPELINE FLOW EFFICIENCIES. p. 253

Ribble, J. M. METHOD FOR MAINTAINING HEATING VALUE OF A FUEL GAS. p. 246

Steiner, K. ELECTRONIC SAFEGUARDS FOR BURNERS. p. 235

12. MATERIALS OF CONSTRUCTION

Cathodic Protection

Parker, M. E. THE RATIONAL APPROACH TO CATHODIC PROTECTION. *Petroleum Engr.*, 23D, 14, 16, 18 (1951) September.

A general discussion is presented on the subject of applying cathodic protection to specific cases.
B. E. Hunt

Schwerdtfeger, W. J. and McDorman, O. N. POTENTIAL AND CURRENT REQUIREMENTS FOR THE CATHODIC PROTECTION OF STEEL IN SOILS. *J. Research Nat. Bur. Standards* 47, 104-112 (1951) August.

Laboratory investigations of the potential of steel in soils of various pH values are reported. The optimum potential for the protection of steel in these soils was determined.
B. E. Hunt

Ceramics

CERAMIC COATINGS FOR METALS. *Ceramics* (British) 3, 321-323 (1951) August.

Ceramic coatings are applied to cleaned metals in the form of water suspensions, either by dipping or spraying, then dried and fired at 2150° F. in oxygen-free atmospheres. Molybdenum specimens so coated showed increased resistance to thermal shock and high temperatures. In an air atmosphere at 1650° F., unprotected molybdenum decreased 0.02-in. in thickness in one-half hour, while there was no decrease for ceramic-coated molybdenum in 70 hours.
J. J. Guyer

SOME PHYSICAL PROPERTIES OF EIGHT REFRACTORY OXIDES AND CARBIDES. *Ceramics* (British) 3, 324-327 (1951) August.

Short-time tensile strength at elevated temperatures, thermal shock resistance, coefficient at linear expansion, and density were the properties determined for the following hot-pressed ceramics: Beryllium oxide, magnesium oxide, stabilized zirconia, zircon, boron carbide, 85% silicon carbide plus 15% boron carbide, titanium carbide, and zirconium carbide. Zirconium carbide was the strongest material at 2,200° F. with tensile strength at 15,850 psi, but had very poor resistance to oxidation. The strongest material at 1,800° F., was boron carbide, with tensile strength at 22,550 psi. but very poor resistance to oxidation and thermal shock. Titanium carbide showed the most promise, with tensile strengths at 15,850 psi. at 1,800° F. and 9,400 psi. at 2,200° F., and the best resistance to thermal shock. A density of at least 93% of the theoretical density can be obtained by hot-pressing.
J. J. Guyer

Coatings

Corfield, G. and Shupp, C. W. LONG-TIME PERFORMANCE OF PIPELINE COATINGS. *Gas* 27, 92-94 (1951) September.

Extensive records have enabled coating failures to be classified as to cause. Specifications and tests are reported which have been developed for quality control.
B. E. Hunt

Liebman, A. J. HELP YOUR STEEL TO HOLD ITS PROTECTIVE COATING. *Chem. Eng.* 58, 326-331 (1951) September.

This is an abstract of a paper on the preparation of various steel surfaces prior to painting.
B. E. Hunt

Corrosion

GAS TURBINE BLADE CORROSION. *Gas and Oil Power* (British), 46, 183-184 (1951) August.

The corrosive attack referred to as vanadium attack of gas turbine blades is discussed. In addition to vanadium, sodium and sulfur also form corrosives.
B. E. Hunt

Parker, M. E. CORROSION AND ITS CONTROL. PART 27. COATING INSPECTION IN THE FIELD. *Oil Gas J.* 50, 111, (1951) September 6.

Inspection should include a detailed knowledge and checking of (1) materials handling and storage, (2) equipment, (3) application techniques, (4) testing and repairing, and (5) handling of coated pipe.
B. E. Hunt

Parker, M. E. CORROSION AND ITS CON-

TROL. PART 28. BONDING NONCONDUCTIVE PIPE JOINTS. *Oil Gas J.* 50, 327, (1951) September 20.

Successful cathodic protection of a piping network requires that it form a single electrical unit. One open pipe joint will defeat protective measures and also will cause the protective current to corrode the nearby unprotected parts. Welded-strap bonds must be used on any questionable mechanical joint.

O. P. Brysch

Parker, M. E. CORROSION AND ITS CONTROL. PART 29. INTERFERENCE EFFECTS IN CATHODIC PROTECTION. *Oil Gas J.* 50, 113 (1951) September 27.

The presence of an interfering structure within the current-carrying area will produce two major effects: the protection of the proper structure will be decreased and the interfering structure will be more susceptible to corrosion. The latter effect may be mitigated by bonding together all structures in the region.

B. E. Hunt

Corrosion-Resistant Tubing

Bulow, C. L. DUPLEX TUBING FOR USE IN THE PETROLEUM INDUSTRY. *Petroleum Engr.* 23C, 5-9 (1951) September.

Duplex tubing, formed by drawing concentric seamless tubes of different metals until a tight friction grip or mechanical bond is formed, is used under certain corrosive conditions. When fluids containing different corrodents are separated by a pipe, such as in a heat exchanger, that metal having the greatest corrosion resistance to one of the corrodents thus may be exposed only to that fluid. Heat transfer coefficients for duplex tubing seem to have values between the values for the values for the two metals.

B. E. Hunt

Pipe Reconditioning

Smith, J. M. and Bullock, R. L. HERE'S HOW INTERSTATE CLEANS OLD GREASE-COATED PIPE FOR FURTHER SERVICE. *Oil Gas J.* 50, 256, 258 (1951) October 4.

The process whereby grease-coated pipe is cleaned by a hot aqueous solution of chemicals and solvents after the usual mechanical cleaning is described. All cleaning, straightening, grading, double jointing, and beveling was performed in a central processing yard.

B. E. Hunt

Sneddon, R. HOW TO RECONDITION PIPE. *Petroleum Engr.* 23B, 37-42 (1951) September.

An inspection trip of a plant built to recondition used pipe and casing is reported. The procedures employed and the capacities of the plant are described.

B. E. Hunt

Pipe Testing

Woodlief, W. H. (assigned to Republic Steel Corp.) PRESSURE TESTING OF PIPE. U. S. 2,565,460 (1951) August 21.

The invention described is a device for pressure testing pipe and maintaining the pipe under tension rather than in compression.

B. E. Hunt

Structural Carbon

Gaylord, W. M. CARBON AND GRAPHITE. *Ind. Eng. Chem.* 43, 2199-2202 (1951) October.

Fabricated carbon and graphite are now commercially available as heat exchangers, pipe fittings, flanges, valves, spray nozzles, submerged burners, circulating steam jets, and bricks. They are used in manufacture of chemicals where corrosive liquids are used or where temperatures above 1370° C. is required. Specific applications in various industries are described in this article.

S. Mori

Welding

Barkow, A. G. HOW TO INTERPRET RADIOGRAPHS OF PIPE-LINE WELDING DEFECTS. *Oil Gas J.* 50, 177-180, 183, 186-271 (1951) October 4.

The common defects which occur in pipe line welding are illustrated. The interpretation of visual observations and radiographs of these defects are described.

B. E. Hunt

Cady, E. L. HIGH QUALITY WELDS OBTAINED WITH LOW HYDROGEN ELECTRODES. *Materials and Methods* 34, 90-91 (1951) September.

New welding electrodes containing materials with a very low hydrogen content have been employed recently with good results. These rods can be used in applications where stainless rods had to be used heretofore. Outstanding weld-metal properties and reduced costs are obtained.

W. G. Bair

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A Literature Study

by

O. P. Brysch
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See Abstract on page 238 of this issue